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REPORT ON THE USE OF ELECTRONIC DATA-PROCESSING EQUIPMENT IN THE FEDERAL GOVERNMENT

PREPARED BY THE

SUBCOMMITTEE ON CENSUS AND GOVERNMENT STATISTICS

OF THE

COMMITTEE ON POST OFFICE AND CIVIL SERVICE

HOUSE OF REPRESENTATIVES

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CONTENTS

	Page
Letter of submittal	v
Introduction	1
Recommendations	3
General planning	3
Personnel matters	3
Use of equipment	4
Importance of feasibility studies	5
Magnitude of the manpower problem	14
Changes in personnel requirements	14
Recruitment	14
Training	15
Employee job security	16
Brief descriptions of selected applications	19
Department of Commerce	19
Bureau of the Census	19
Department of Defense	22
Army	22
Finance Center	22
Ballistic research laboratories	26
Navy	27
Electronics Supply Office	27
Manpower information system	29
Air Force	31
Engine management system	31
Leased communications program	34
Department of Health, Education, and Welfare	38
Social Security Administration	38
Department of the Treasury	42
Payment and reconciliation of Treasury checks	42
Issuance and retirement of U.S. savings bonds	50
Civil Aeronautics Board	52
Veterans' Administration	57
Inventory of electronic computers in the Federal Government	61
Appendixes:	
A. List of electronic computers in the Federal Government by make and model	86
B. Comments of the Civil Service Commission on "Report of Survey of Personnel Problems of the U.S. Government in the Adoption and Use of Automatic Data Processing Systems"	94
C. "A New Look at ADP Systems—Government-Wide"	108

LETTER OF SUBMITTAL

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON CENSUS AND GOVERNMENT STATISTICS,
COMMITTEE ON POST OFFICE AND CIVIL SERVICE,
August 19, 1960.

Hon. TOM MURRAY,
Chairman, Committee on Post Office and Civil Service,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: The Subcommittee on Census and Government Statistics, under authority of House Resolution 78 of the 86th Congress, has made a study of the use of electronic data-processing equipment by the Federal Government. This is one aspect of the subcommittee's continuing review of data compiling and processing activities of the Federal departments and agencies, which has produced a number of reports and hearings.

During our hearings on "Plans for Taking the 1960 Census," the Director of the Bureau of the Census emphasized the important part the use of electronic data-processing equipment will have in facilitating a timely release of the statistics developed in the 1960 census. The subcommittee's attention has also been called to the widespread use of electronic data-processing equipment in other phases of the Nation's Government-wide statistical activities.

Closely related to the subcommittee's interest, as to the use of this equipment in the Government statistical activities, is the broader subject of how the use of such equipment affects manpower requirements throughout the Government, and the extent to which the use of such equipment might affect employee job security.

The present report covers an exceedingly important and timely subject. The application of electronic computers to Government work—administrative, statistical, and scientific—is developing into very large proportions.

The report includes an inventory of electronic computers in the Federal Government, which indicates that as of June 30, 1960, the Government was utilizing 524 electronic computers, exclusive of those for tactical and classified uses in the Department of Defense. Included in the report are recommendations dealing with general planning, personnel matters, and use of equipment.

I believe this report will be of interest to the members of the committee and to the Congress.

Sincerely yours,

JOHN LESINSKI, *Chairman.*

INTRODUCTION

Under House Resolution 78 of the 86th Congress—

the Committee on Post Office and Civil Service, acting as a whole or by subcommittee, is authorized to conduct full and complete investigations and studies with respect to the following matters within the jurisdiction of the committee: * * * (3) the application, operation, and effect of the laws, rules, and regulations relating to the management of civilian personnel of the Federal Government; * * * (10)(A) the organization, management, and operations of the Bureau of the Census in the Department of Commerce and (B) statistical and related activities other than those of the Bureau of the Census; * * * and (12) the operation and effect of training programs under the Government Employees Training Act.

The Subcommittee on Census and Government Statistics, established early in the 86th Congress, has exercised this authority by holding hearings, conducting special studies, and compiling information furnished by the various departments and agencies. Open hearings published to date include "Use of Electronic Data-Processing Equipment," June 5, 1959; and "Office Automation and Employee Job Security," March 2 and 4, 1960; as well as "Plans for Taking the 1960 Census," April 8, 1959; and "Final Plans for 1960 Census," March 18, 1960. Studies published to date include "Preliminary Report on Business Reporting Requirements of the Federal Government," December 6, 1959; and "Data Compilation Activities of the Federal Government: Personnel and Contract Costs" (H. Rept. 1357), March 3, 1960.

The present report exemplifies the deep interest of the subcommittee in the rapidly growing use by the Federal Government of electronic data processing, and the impact of this development upon Government statistical activities and upon Government personnel. It is based upon the subcommittee's hearings, studies made by the staff assigned to the subcommittee, and materials provided by the agencies of the Government.

For certain portions of this report intended as informational background as distinguished from subcommittee recommendations and opinions, particular use was made of materials furnished by Government agencies or officials. The information presented in the section of this report entitled "Brief Descriptions of Selected Applications" is a reproduction, largely without major change, of statements submitted by selected agencies in reponse to subcommittee request.

The information included in the section of this report entitled "Inventory of Electronic Computers in the Federal Government" and in appendix A is derived in the main from information collected by the Bureau of the Budget, pursuant to its Bulletin No. 60–4, from the Federal departments and agencies. The subcommittee collaborated with the Bureau of the Budget in planning joint use of the results of that survey in order to minimize the reporting burden upon the agencies.

Appendix B comprises the comments of the Civil Service Commission on the "Report of Survey of Personnel Problems of the U.S.

Government in the Adoption and Use of Automatic Data Processing Systems" which had been prepared for the Bureau of the Budget by Lester B. Knight & Associates, Inc. Major portions of the Knight report were included as an appendix in the record of the June 5, 1959, hearing of the subcommittee.

Appendix C comprises a recent address at the Federal Government Accountants Association Ninth Annual Symposium by John A. Beckett, Assistant Director of the Bureau of the Budget, entitled "A New Look at ADP Systems—Governmentwide." It provides a very useful summary of the conclusions to date of studies conducted or participated in by the Bureau of the Budget.

In conducting this study, the subcommittee has adhered generally to the following definition: Electronic data-processing equipment refers to equipment which uses electronic circuitry, internally stored instructions, and memory storage as the means of processing digital data.

Under this definition, it can be said that the Government's entire experience with large-scale electronic data processing has occurred within the past decade, beginning with the first installation at the Bureau of the Census in 1951. The rapid expansion within just a few years has been truly revolutionary, and the prospects for future development may make the recent past seem like mere prolog. Not only the Federal Government but the entire national economy is involved. A national magazine recently stated that the computer industry promises to grow to $1.5 billion in sales, servicing, repairs, and programing this year, and, by one estimate, to $20 billion in the next decade (Newsweek, July 4, 1960, p. 66).

Not only in sheer magnitude but in diversity has the spread of electronic data processing been impressive. Other parts of this report provide some examples of the manifold applications which have already appeared. Although the definition used tends to emphasize business and statistical use, the growing importance of digital computers in scientific research and operations must be noted. One-time scientific research applications place a heavy burden on programing manpower and on machine availability and point up the special desirability for such needs of a central service center for electronic data processing. The burgeoning state of electronic data processing will require continued study and further thinking.

RECOMMENDATIONS

Based upon the subcommittee hearings, and studies and materials provided by the agencies of the Government, the following recommendations were developed by the subcommittee:

General planning

1. Installation of electronic data-processing equipment should be preceded in all cases by a comprehensive feasibility study having top management support and involving a review of the entire system.

2. No matter at what level within the agency or department a feasibility study is launched, consideration should be given to the possibility of wider integration of needs and uses beyond the immediate interest, to take advantage of the economy and scope of centralized large-scale equipment.

3. A policy should be determined centrally for the guidance of agencies in determining whether to rent or to purchase electronic data-processing equipment.

4. More attention should be given to achieving compatibility within and between electronic data-processing installations, through greater standardization of specifications and through development of data and program conversion techniques and devices.

5. An experimental service center for electronic data processing should be established within the Government.

6. Governmentwide orientation courses, centrally directed, should be maintained to provide executive and management officials with a basic understanding of the principles of evaluating, installing, and managing electronic data-processing systems.

7. Periodic inventories, including information on uses and costs, should be taken of electronic data-processing equipment held by the Government.

8. The Interagency Committee on Automatic Data Processing should be continued with better staff support provided by the Bureau of the Budget.

Personnel matters

9. Personnel officials should be included in the general planning for electronic data processing equipment at the point a decision is made to utilize it.

10. Where a net reduction in employment is expected to occur as the result of the introduction of electronic data processing, every effort should be made to accomplish it by normal attrition and not by reduction-in-force procedures.

11. Adequate advance notice of conversion to electronic data processing should be given to all employees who might be affected. Communication between management and employees should be maintained throughout the progress of the conversion process.

12. Retraining to equip with electronic data processing skills should be made available at Government expense to employees scheduled for displacement. The provision should be made sufficiently

in advance of conversion to enable employees who are qualified to be retrained to obtain first consideration for the new jobs.

13. When there is a displacement of employees resulting from conversion to electronic data processing, the agency should impose a freeze on hirings in those grades for which the displaced employees can qualify within the agency.

14. Transfers to other jobs of employees displayed by electronic data processing should be effected on the broadest possible basis—to other parts of the agency, other agencies in the locality, and other localities. When necessary, the Government should take steps to assist employees to obtain jobs in private industry.

15. Government rates of pay for key electronic data-processing personnel should be maintained at levels consistent with those of private industry.

Use of equipment

16. Electronic data processing generally should be restricted to operations which are important in the making of decisions, and not filled up with miscellaneous jobs for which it is not well suited.

17. The number and complexity of reports turned out by electronic data-processing equipment should be limited, in each application, to that which is actually needed. The equipment should not be permitted to become a gigantic "paper mill" simply because of its speed and capacity.

18. The ability of electronic data-processing equipment to make simple, preprogramed decisions should be fully exploited. Output reports for decision-making purposes should be limited to those unusual items requiring executive decision.

19. Surplus time on electronic data-processing equipment should be made available on a reimbursable basis to other parts of the agency and other agencies. A central exchange service, as well as an interdepartmental exchange service, should be established to coordinate supply and demand relating to spare time.

20. Programing work and input data preparation should be initiated at a sufficiently early date to provide adequate useful workload for the electronic data-processing equipment beginning with its expected acceptance date and for each interval of use thereafter.

21. The Bureau of the Budget and other Government agencies should consider the feasibility of using electronic data-processing equipment to speedup and improve the budget preparation processes.

IMPORTANCE OF FEASIBILITY STUDIES

The first and perhaps most important step in the introduction of electronic data processing is the feasibility study. The capital investment and the operating expenses of an EDP installation, and its impact on personnel, are so great that a sizable outlay for a preliminary study is readily justified. Even if management's mind is irrevocably made up in favor of EDP (whether for sound or unsound reasons), the feasibility study will pay off in pointing to improvements in the entire data-processing system and to the best choice among competing equipments and applications.

Unsound reasons for acquiring electronic computers do exist. One is simply to "keep up with the Joneses." Professed success with EDP in one agency is not sufficient reason for introducing it into another. A second inadequate reason is the existence within the agency of large-scale data-processing work being done by less modern methods. The less modern methods are not necessarily more expensive or slower than electronic procedures. If they are inefficient, the fault may lie with the system rather than with the hardware.

The feasibility study should begin with a determination of what information is really needed, before it proceeds to an examination of methods of producing it.

The electronic data-processing equipment commercially available today is generally so flexible that it can be used efficiently for a variety of applications. This general-purpose ability makes it all the more advisable that a broadly conceived feasibility study precede adoption, because such a study can lead to much more widely integrated use of the computer than the narrow use that may have been originally contemplated. In this sense, the feasibility study differs from and precedes what may be called an "application" study, in which the efficiency of a particular predesignated application is examined.

Good feasibility studies may be expensive. In a group of Government EDP installations studied by the General Accounting Office, the cost of the feasibility study alone was found to range in cost from $20,000 to over $100,000. (See "Use of Electronic Data-Processing Equipment," hearing before this subcommittee, June 5, 1959, app. B.) Costs of such studies can be recovered only by important improvements in systems or by really profitable applications. Thus preliminary screening is indicated prior to a full-scale feasibility study.

A well-managed feasibility study in a properly screened situation is likely to be worthwhile whether it "succeeds" by endorsing the acquisition of EDP equipment or "fails" by recommending against it. In the former instance profits can accrue through the integration of operations, faster and cheaper processing, and the production of more information than had been possible before. In the latter case, the feasibility study can lead to improvements in the system so as to accomplish desired goals without EDP, and to the avoidance of heavy losses through an unwise plunge into EDP. When the indicated answer is negative as to electronic computer acquisition, a hard-hitting feasibil-

ity analysis report may be required to bring the facts home to executive officials dazzled by the glamor of the "giant brains" and eager to join the parade.

The best potential uses for an electronic computer are not likely to be programs already highly mechanized, like payroll preparation. It would be very difficult to recover the cost of a computer installation and pay for its maintenance from just the marginal savings, if any, that could be skimmed off an established efficient operation. Economic justification for EDP is more likely to be found through new and broader approaches to data processing involving more highly integrated operations, the ability to do important new things, and the value of faster and better information for decisionmaking.

The General Accounting Office has been a consistent advocate of the importance of feasibility studies, and has instructed its auditors and examiners to review and evaluate EDP feasibility studies made by Federal agencies. Circular letters have been issued by the General Accounting Office relating to feasibility studies. The first, issued on September 14, 1957 (B–115369), is entitled "Accounting and Auditing Aspects of Automatic Data Processing." The second, issued on January 14, 1959 (B–115369), is entitled "Automatic Data Processing Systems: Feasibility and Application Studies and Retention of Records."

A recently-issued authoritative bulletin by the Bureau of the Budget will be of significant help to agencies contemplating EDP acquisition. One of the fruits of the work of the Interagency Committee on Automatic Data Processing, provides a set of guidelines for a feasibility study. The bulletin is reproduced below.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., March 18, 1960.

Bulletin No. 60–6.

To: The heads of executive departments and establishments:
Subject: Automatic data processing (ADP) program of the executive branch: Studies preceding the acquisition of ADP equipment.

1. *Purpose.*—This bulletin transmits "Guidelines for studies to precede the utilization of automatic data processing equipment," copy attached.

2. *Background and status of the report.*—The attached report was prepared by a task force of the Interagency Committee on Automatic Data Processing, accepted by the Committee and submitted to the Bureau of the Budget with the recommendation that it be published for the guidance of all concerned.

Experience to date in the acquisition and utilization of ADP equipment has demonstrated that a thorough analytical study should be conducted before decisions are made relative to the economic and operational feasibility of any ADP application. For use in studies of this kind, the attached report provides useful guidelines which have been developed from the experience of the people in the agencies who have been directly involved in ADP analytical studies.

MAURICE H. STANS, *Director.*

(The following report was prepared by a Task Force of the Interagency Committee on Automatic Data Processing, approved by the Interagency Committee and submitted to the Bureau of the Budget, November 1959:)

Attachment to Bureau of the Budget Bulletin No. 60–6, dated March 18, 1960.
Subject: Guidelines for Studies to Precede the Utilization of Automatic Data Processing Equipment.[1]

[1] Studies of this nature have in the past been referred to as feasibility studies. These guidelines provide for systems analysis to follow a preliminary analysis or "feasibility study." (See IV.)

I. PURPOSE AND SCOPE

The purpose of this report is to provide guidelines to all Government agencies as a basis for planning and conducting studies (excluding those which have military tactical objectives) preceding a decision to utilize automatic data processing equipment.

Studies as described herein include complete systems analyses and functional surveys of areas subject to possible automatic data processing application.

II. SELECTING AREAS FOR STUDY

1. A knowledge of the missions, functions and systems of an agency plus an orientation in the capabilities of automatic data processing will usually permit a determination to be made as to those areas worth exploring.

In general, such areas are characterized by one or more of the following:

a. Large volume repetitive operations.
b. High clerical costs.
c. Complex computational problems.
d. Urgent time scheduling factors.

2. Some of the more effective applications have been in:

a. Statistical data processing and analysis.
b. Traffic analysis.
c. Account maintenance.
d. Supply activities.
e. Payroll activities.
f. Personnel activities.
g. Engineering cut-and-fill computations.
h. Load scheduling.

This is not a definitive list—many areas have been exploited.

3. The areas for study may be selected by one knowledgeable individual or a very small group. The object is to select the general area for a study. The selection may cover a wide range of activities cutting across many organizational lines or it may be limited to a specific operation.

III. PLANNING THE STUDY

1. *Problem definition.*—When the organization or area to be studied has been selected the objective and scope of the study should be clearly defined. A time schedule and an order of priority should also be established. A directive or authorization from an official having high level responsibility should have sufficient information and the necessary authority to explore and review all pertinent activities.

2. *Obtaining top management support.*—One of the most vital preliminary steps in planning an automatic data processing study, as in the case of any significant undertaking, is to obtain top management support. To accomplish this, suitable presentations, orientations, and briefings have proved to be of considerable value. Management support must be insured because of the time involved in gathering facts, and the systems analysis involved in the study. Support is also required to effect organizational and procedural adjustments which may be necessary to improve the selected system prior to commencement of a study. It must, therefore, be made clear to all concerned that management is desirous of effective results from the study.

3. *Employee relations.*—The initiation of ADP studies sometimes results in alarm on the part of the staff and working force because of a concept that modern machines displace people. Employees should be completely informed so as to obtain their full cooperation. Some agencies have adopted a policy which provides that any resultant personnel adjustments may be accomplished by attrition or minimized by reassignment in preference to reduction-in-force procedures.

IV. PRELIMINARY ANALYSIS

An ADP study can be a lengthy, complex, and costly undertaking. For these reasons, a preliminary analysis or "feasibility study" should be made to determine the overall soundness of applying ADP to the operations of an organization. The following actions are suggested:

1. *Informational requirements.*—Establish an inventory of data processing by major functional areas such as those described in Section II, paragraph 2. Additionally, it is necessary to secure or develop a distribution of man-hour effort and

other significant cost elements to be used in identifying costs by major operation, function and/or organization.

2. *Analysis.*—The analysis of data developed should be undertaken in a logical sequence. Several starting points are suggested, namely, unmangeable backlogs, those operations which are the most costly, take the most time, or are presently mechanized. The analysis should be made from the point of view of determining the best method to accomplish the mission and to expedite the workload, and not of merely substituting an electronic computer for manual or mechanized methods. In examing these methods, it should not be assumed that every operation being performed is essential to the overall mission of the organization, to the segment of the organization, or that the operation is authorized. In other words, it is important, initially, for the study group to determine along with staff personnel, the data requirements which are considered necessary to effectively manage the respective operations. The elimination of voluminous or costly reports, records, or operations may make the difference between the need for a large computer or medium and small computers or whether ADP is needed at all. In certain activities where fast information is the most important objective, speed over economy would receive primary consideration.

It naturally follows that when needs of management have been established, determination must be made as to the source data available to provide the end products required by management and, if not available, how the source data can best be made available. Only after this has been accomplished can measures be taken to determine the most appropriate system (ADP, manual, or conventional type equipment) to satisfy the needs of management.

3. *Determination of impact.*—The end product of the preliminary analysis should include determinations regarding the areas susceptible to immediate or ultimate application, the size and cost range of equipment, the extent of the conversion problem, the sufficiency of available resources to support ADP, the expected economies and benefits, and the overall effect of computer use on the personnel, procedures, and organization. The preliminary analysis should identify the organizational units that might be affected by the possible utilization of ADP and make adequate provision for participation by staff representatives of such units in the subsequent studies.

4. *Decision.*—If the preliminary analysis shows that application of ADP is *generally* justified, further and more definitive plans are in order to proceed with a full systems study.

V. THE TASK FORCE

1. *Composition.*—The careful and judicious selection of competent personnel is vital to the success of any ADP study. The chairman, and as many additional personnel as are necessary, should be relieved of all other work and assigned to the Task Force on a full-time basis. A small full-time Task Force is to be preferred to a larger part-time "Committee-type" group. This Task Force should have sufficient permanence and the continued service of personnel so as to properly accomplish the objectives of the study. The Task Force should include personnel with the following skills:

a. Familiarity with the systems and operational and management needs of the organization.

b. General understanding of the theory, operation, capabilities, and limitations of computers, punched card equipment, and conventional office machines.

c. Background in management engineering techniques, systems analysis, and design.

2. *Responsibility to management.*—The Task Force should be organized and conducted so as to keep top management fully informed of the following:

a. Justification for the expenditure of manpower and funds to continue or extend the study.

b. Problems which may require policy decisions at a higher level of authority.

c. Management improvements which may be made during the course of the study or at a later date depending upon the benefits to be derived from improvements.

d. Circumstances and justification for a decision that Automatic Data Processing would not be applicable and that further consideration for the procurement of ADF equipment would not be necessary.

e. The identification of processes which can be improved without resorting to ADP.

VI. THE SYSTEMS STUDY

The principles of systems analysis and other management engineering techniques are essential to the successful accomplishment of the systems study. The basic elements of a systems study are discussed below:

1. *Recording the facts.*—Establishing the relationship of documents, one to the other, and to the organizational elements engaged in processing such documents, is the starting point in reflecting the detailed description of the present system. Strong emphasis is placed on the importance of documenting in detail what is being done, where it is done, uses made of it, the frequency required, and an accurate reflection of how it is done and the complexity of the process. The use of flow charts, sequence and process charts, and organizational tables will facilitate recording the facts.

2. *Preliminary evaluation.*—An overall examination and evaluation of the facts and the flow process charts should be made to establish the basis for eliminating duplication, combining details, rearranging sequences, validating records and reporting requirements, or eliminating a process or processes which are not necessary. Conversely, this would result in the addition of a process not now being performed but which should be performed so as to provide essential records and reports not heretofore established.

3. *Basic systems design.*—The success of the systems design will depend largely upon the degree to which certain basic principles are applied. Some of the more important basic principles are described as follows:

a. Adopt a uniform approach. Effective results in the review and analysis of information developed in the factfinding phase require that personnel assigned to the study accomplish their findings in the same manner and record their results uniformly; otherwise, the findings will be of little value. To insure a common approach, it is necessary that a well-planned program be developed.

b. Apply machine logic when recording facts about current systems. The meticulous, detailed programing of instructions is the largest single task in converting an operation to automatic data processing equipment. If machine logic and the language of the computer were applied during the design of the system, a tremendous step toward ultimate machine programing would be assured.

c. Capitalize on the capabilities of the equipment. The ability to store reference data internally, with rapid access time, is one of the principal advantages of electronic digital computers. This advantage usually eliminates the need for intermediate documents and manual data manipulation. An additional advantage lies in the flexibility of the equipment, through programing, which can produce an end product in multiple formats. These and many other capabilities provide the basis for integrated data processing to an extent not heretofore possible with conventional-type equipment.

d. Convert to machine language at the earliest possible processing stage. The early conversion of source document information to machine language is an important factor in designing an optimum automatic data processing system. The ideal process would be the simultaneous preparation of the source document and input data in machine intelligible language.

e. Integrate data processing to the maximum extent. Whenever source documents are used for multiple purposes, thorough consideration must be given to the possibility of integrating the systems involved. For example, a source document used for item accounting is also used in accounting for dollars. An integrated system would permit the updating of item and dollar accounting from one entry of the source document data into the system.

f. Employ the exception principle. ADP can produce complete reports for reference, audit, and record. However, whenever possible, management reports should contain only those items of information which vary significantly from the normal and require the attention of management.

An understanding of the general capabilities and limitations of these equipments (including basic programing) will provide a proper background to determine whether desirable end products are possible, and how the systems must be designed to produce desired results and a well-balanced system. The new system must be constructed in the form of schematic and flow process charts and source document designs. Also, organizational, supervisional, and clerical requirements must be restated in view of the new procedures.

4. *Development of systems specifications.*—During the design of the new system, specifications should be developed to provide a sufficient base to relate and evaluate

the various equipment potentials. The following systems specifications represent the minimum information for this purpose:

a. Input: A description of all known input, including:
   (1) Method or medium by which data will be received or developed.
   (2) Format, message length, alpha-numeric or other identifying characteristics.
   (3) Daily volume, including cyclical peaks.
   (4) Hourly rate at which equipment should receive data.

b. Maintenance of information: A description of the information to be maintained, including:
   (1) Volume of records.
   (2) Methods of file maintenance.
   (3) Proposed record lengths.
   (4) Alpha-numerical requirements.
   (5) Requirements for interrogation.

c. Data handling: A detailed description of each type of transaction or computation to permit a proper assessment of the problem. It is not desirable, necessarily, at this point, to prescribe specifically how each transaction will be processed because different types of equipment may require deviations in procedural steps while accomplishing the same results.

d. Output: A description of output needs, including:
   (1) Kind of output and distribution thereof; i.e., punched card, paper tape, printed copy, etc.
   (2) Daily volume by type of output.
   (3) Required formats.
   (4) Time after cutoff within which output should be produced.
   (5) Time cycle to accomplish each transaction.

e. Other requirements:
   (1) Date for equipment delivery and installation.
   (2) Arrangements for maintenance of equipment.
   (3) Requirements for compatibility with other equipment.
   (4) Expandability to accomplish added workloads.
   (5) Other requirements peculiar to the application.

5. *Equipment evaluation and selection.*—Selection of equipment within the framework of the systems specifications developed may be accomplished through:

a. Analysis of manufacturers' brochures and government contract schedules.

b. Consideration of knowledge of personnel concerned with the study and information obtained from users.

c. Negotiations with or solicitations of proposals from manufacturers.

Qualified sources of supply should be considered and equal information opportunity and facilities be made available to each potential supplier. There is no requirement, however, to consider any equipment that does not exist in at least prototype form but there is no restriction against considering such equipment. Analysis of equipment should proceed so as to develop equipment costs, including make, model, and quantity of components and any supporting conventional punched card equipment. The inability or reluctance of a qualified manufacturer to make a specific proposal does not absolve the agency from its responsibility, in its own interest for considering that particular equipment. Consideration should also be given to personnel requirements related to the various models and kind of equipment available. Other costs which should be included in this consideration are space and air conditioning, site preparation, maintenance, power, and miscellaneous electrical installation.

Evaluation and selection of equipment requires a detailed analysis of the following:

a. Capabilities of the machine to do the job:
   (1) Acceptance of input documents and data.
   (2) Sufficiency of storage and processing capacity.
   (3) Adequacy of data handling.
   (4) Production of output in required form.
   (5) Adequacy of controls and accuracy.
   (6) Adaptability to long-range plans.

b. Time taken to do the job:
   (1) Hours of use in relationship to potential hours.
   (2) Capability to achieve processing and interrogation cycles.
   (3) Potential for expansion.

c. Acceptability:
   (1) Availability.
   (2) Adequacy of maintenance and training services.

d. Advantages of use:
(1) Timeliness of data production.
(2) Production of data desired but previously not available.
(3) Economy.
(4) Other tangible or intangible benefits to be gained.

6. *Items to be included in the ADP systems study recommendations.*—A carefully documented ADP systems study would normally include the following:

a. Definitive indications of the benefits that are expected to accrue from the proposed system that cannot otherwise be attained, and justification for these benefits in terms of economic gains or improved management effectiveness.

b. A general description of the data processing needs of the activity in relation to the basic mission of the activity.

c. Workload and employment statistics describing the magnitude of the activity's problem.

d. A chart depicting the organizational effect of ADP on the activity as well as showing the location of the proposed data processing function.

e. Flow charts supplemented by clear and precise narrative indications of the nature and scope of each application. There should be included for each application the following:
(1) A description of the contents and purpose of proposed outputs.
(2) A description of the content and source of all input data.
(3) Record lengths and number of records.
(4) Processing frequencies.

f. Narrative descriptions of those present systems which correspond to the proposed applications.

g. Detailed comparative cost data for the proposed system and the present system, adjusted by improvements developed in the course of the study.

h. Indication of personnel implications in terms of reduced or augmented staffing needs.

i. Indications of the availability of and expected costs of site preparations.

j. Projected schedule should be provided covering plans for equipment selection, detailed application development, personnel training and orientation, site preparation, installation, transition and attainment of normal operations.

k. Indications that consideration was given to locating or obtaining equipment which could be shared with other bureaus in your agency, or with other agencies.

l. All factors which might have a bearing upon top management's decision, including problems or disadvantages.

VII. EVALUATING THE ADP SYSTEMS STUDY

Results of the ADP systems study should be evaluated in the light of the following:

1. *Improved operational effectiveness, economy,* and *efficiency* are the principal objectives.

2. *Integration of Data Processing.*—Planning for ADP should take into account the interrelations (both horizontal and vertical) among the needs of management for information.

3. *Systems improvement.*—Mechanization of existing methods may merely compound existing inefficiencies. Speeding up existing procedures is not enough; the real aim is not to speed up an old job, but to do a better job. Adequate planning should start with the end product or final program requirements of the whole activity, with minimum regard for prevailing organization, methods, and equipment.

4. *Operational benefits.*—Emphasis should be directed toward those areas with the greatest potential "before and after" difference in effectiveness, efficiency, or economy of the *entire* operation or entire sequence of information flow within which an ADP system can be only a segment. Thus, some installations may produce large overall savings by increasing the effectiveness of program operations even though direct data processing costs are increased.

5. *Management by exception.*—Planning for ADP should provide for using the computer to make routine logical decisions and to print out for detailed analysis only those exceptions to established routines which require human judgment.

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6. *Reorganization.*—ADP planning should anticipate and reflect possible changes in organization and procedural concepts to utilize the capabilities of ADP systems as management tools.

7. *Alternative ADP organizational placement.*—At the bureau or departmental level consideration should be given to:

a. The possibility of obtaining equipment capable of combining the proposed ADP application with one or more applications at a higher organizational level;

b. The possibility that the proposed ADP application could be relocated and combined with activities of other organizational offices of the same agency or department;

c. The possibility of centralizing a particular operation or service nationwide in scope (such as the processing of paid money orders in the Post Office Department or paid checks in the Treasury Department).

8. *Economic considerations.*—An expectation of direct or indirect economic advantage should be evident, and generally the equipment should be on a breakeven basis within a reasonable time after installation; however, this principle does not preclude consideration of intangible benefits. If an ADP system can do the job, a basic question is, will an ADP installation economically pay off? It is hard to evaluate on a strict dollar basis the benefits to be derived from having heretofore inaccessible information that an ADP system may provide.

However, the Task Force can and should weigh the cost of an ADP system against (1) clerical savings, (2) saving in presently-used machines, (3) the value of greater accuracy and speed, and (4) savings due to less space devoted to files and storage.

The report of the Task Force should include in some detail data on expected savings if an ADP system is recommended. In determining these savings such factors as cost of the equipment, cost of preparing facilities for the equipment, labor costs with and without the equipment, supplies, power requirements, and storage costs, should be considered. Savings may not be realized until the equipment is in use for a reasonable period of time after the system has been installed. Cost savings due to systems improvements resulting from the study should not be reflected in this analysis as savings resulting from the use of ADP, but, rather, should be set out separately.

9. *Selecting specific equipment.*—If the Task Force recommends adoption of an ADP system, and if the recommendation is accepted, the problem arises as to the type of equipment to obtain. Normally, the Task Force should propose specific equipment in its recommendation. Equipment available from several manufacturers should be considered in making a decision as to the type and make of equipment to be ordered. Due consideration should be given in selecting ADP equipment to the availability of repair and maintenance service, especially when an agency is located in a remote area.

10. *Adequacy of the ADP systems study.*—It is difficult to offer a complete checklist for review of a systems study; however, to supplement the reviewing authority's judgment and stimulate thinking in this area, the following should also be considered:

a. Was the composition of the Task Force such that they could be reasonably expected to make an adequate and objective study?

b. Was the approach of the Task Force the more desirable one of reviewing and redesigning procedures, or merely of using the proposed equipment to do more rapidly what already is being done? Was a functional survey made and a careful and critical study of existing data processing methods and reporting requirements conducted?

c. Was consideration given to results of studies of ADP made at similar segments of the same agency or at other agencies?

d. Were block-diagram flow charts prepared?

e. Were architectural and engineering requirements fully considered? For example:

(1) Space layout,
(2) Floor loading factors,
(3) Power requirements,
(4) Air conditioning, humidity and dust control,
(5) Lighting and accoustics.

f. Was too much reliance placed on data from one manufacturer? Before specific equipment is selected, the characteristics of various machines should be studied and compared.

g. Were the relative merits of purchasing and renting equipment considered?

h. Was full consideration given to the economic advantages and disadvantages of acquiring an ADP system? The cost of an ADP system should be weighed against the anticipated benefits of clerical and other savings and the value of greater speed and accuracy.

i. If dollar savings are forecast in the study, was provision made to review the estimates for reasonableness and to relate the actual experience of the installation to these predicted savings?

j. Did the Task Force review reports on other studies for ADP equipment used in similar types of programs in order to ascertain whether any items requiring consideration might have been overlooked in the study?

The above suggestions are not intended in any way to restrict the reviewing authority's ingenuity in reviewing automatic data processing system studies. Such reviewing authorities may contact the ADP staffs of the Bureau of the Budget or the General Accounting Office for consultation or suggestions as to methods of reviewing studies. However, it should be understood that in all cases the decision to acquire and utilize ADP equipment rests solely with the agency involved, subject to its internal departmental or other controls.

MAGNITUDE OF THE MANPOWER PROBLEM

Changes in personnel requirements

Hearings before the subcommittee produced testimony that in 1958 there were over 4,000 Federal Government employees engaged directly in the use of electronic data-processing equipment in six specified EDP occupations, and that the number in these new occupations was expected to increase to 13,000 by 1963. Annual payrolls for these employees were $27 million in 1958 and are expected to exceed $80 million in 1963. Much larger numbers in other occupations are indirectly involved: clerks, statisticians, accountants, engineers, administrators, etc. Involved in a negative way are large numbers of employees whose jobs have been or may be made obsolete by EDP developments.

Similar and correspondingly larger changes are occurring in the private sectors. According to one estimate, 170,000 computer personnel will be needed by 1966. Competition from private industry aggravates the Government's staffing problems, not only in recruiting, but in retaining trained employees. Failure to compete successfully can lead Government agencies to contract out EDP work to private firms, thereby acquiring the services of experts at higher salaries than Government pay scales permit.

Further complicating the problems of personnel requirements are the EDP-induced changes in geographical, as well as occupational, distribution of employment. For example, the conversion to EDP of Treasury Department check processing combined at one location operations previously performed at 14 separate locations. Centralization of payroll processing and of inventory recordkeeping typically has a similar effect.

Human factors are the most important in a conversion to electronic data processing, and a new application, to be successful, should be designed and timed to take account of those factors—availability of workers, training needs, relocation needs, etc.

The growing magnitude of the manpower problem has reached the point at which central direction is needed. Until the present, the problems have been faced individually by each agency or bureau. A variety of expedients have been resorted to. There have been some valuable and instructive pioneering efforts and there have been some mistakes that could have been avoided through proper counseling. It is time now for the Government to summarize its scattered experience, develop standard procedures, and entrust the enforcement and further development of them to appropriate central authority.

Recruitment

The record of the hearing of June 5, 1959, before this subcommittee includes as an appendix major portions of the report on personnel problems of the U.S. Government in the EDP field prepared by Lester B. Knight & Associates, Inc., on behalf of the Bureau of the Budget.

The Knight study gave special attention to recruitment problems. It reached the conclusion that unless extraordinary measures are taken, the Federal Government will continue to be outbid in the labor market. It will not get the best of the newly educated, and it will lose its own trained personnel. The problem will be more difficult with respect to business-type applications than with respect to scientific uses. Specific recruitment difficulties cited included some reports from field establishments that young people did not wish to get involved with the Government, some indications that grade levels for top EDP jobs are too low, and the lack of adequate, centrally developed standards for selection of EDP personnel.

The Civil Service Commission has given careful consideration to the Knight report. Its comments on the conclusions and recommendations with respect to recruitment and other personnel matters have been made available to the subcommittee and are reproduced as an appendix to this report. The Civil Service Commission only partially agrees with the Knight report's assessment of the problem but does agree that personnel problems exist. It points to recent and planned improvements that are expected to strengthen the Government's position.

While the Interagency Committee on Automatic Data Processing is not on record as wholly endorsing the conclusions of the Knight report, there is at least a minority view that inadequate pay for EDP personnel is a major problem. Unless the Government can be competitive with outside industry for needed personnel, this view maintains, use of modern data-processing methods by the Government will be held back, or else the Government will have to contract with private firms for much of its electronic data processing.

A study made by the Comptroller General points to the retention of trained personnel as a major problem which has impeded the development of electronic computer installations. The problem is related to the competition for personnel between the Government and industry. Retention of trained employees is vital if the Government is to make continued progress in the development of electronic data-processing systems.

Training

In a rapidly growing and technical field like electronic data processing, training of personnel is necessarily a major factor in meeting manpower demands. Educational institutions are not yet beginning to turn out young people with EDP skills in substantial numbers. Personnel whose experience has been gained in older methods are not equipped for the new jobs until they have been given specialized instruction. Because the new jobs require, in some cases, different aptitudes from the old lines of work, careful selection must be incorporated into the training program. While there may be a sufficient supply of employees and applicants with the requisite latent abilities, there is a problem of devising and applying efficient selection criteria, and there is a problem of finding and utilizing competent trainers.

The Knight report cites training as the area revealing the most acute problems. The report makes many specific recommendations under the groupings of (1) intragovernmental technical cooperation, (2) use of extragovernmental training resources to maximum advantage, and (3) support to universities for personnel development not

only to meet immediate needs but for the more advanced applications of the future.

Up to the present time, most of the personnel needs have been met through intra-agency training, using trainers provided by the agency or by the equipment manufacturer, of personnel already familiar with agency systems and operations. Such personnel will continue to be a prime source of trainees, but it is to be hoped that selection and training methods will be improved and that the improved methods will be made more widely available. Training of even carefully selected candidates already familiar with agency systems requires a minimum of 1 to 2 months of basic instruction in equipment characteristics and programing, and up to a year of on-the-job training.

The Interagency Committee on Automatic Data Processing, through its task force on orientation and training, has been studying this area. In its preliminary findings, it recognizes that up to the present nearly all orientation and training in the Government has been supplied by non-Governmnet facilities or organized and conducted by each agency for its own personnel. Much progress has been made through such programs, and there has bee some interagency training through the opening of individual agency programs to guests from other units and through interagency consulting. The Government Employees Training Act has made it possible, beginning in 1959, to establish a more aggressive interagency training program.

The Civil Service Commission has already organized and conducted several interagency orientation and appreciation courses for executive and management officials. This beginning should be followed by an extension to other kinds of centrally organized training courses in various aspects of electronic data processing, including systems analysis. Some agency other than the Civil Service Commission, e.g., the Bureau of the Budget, may be the appropriate center for some of this training work. It might be desirable later for regional training facilities to be established.

Employee job security

The committee and its individual members have consistently expressed concern about employee job security under the impact of office automation. Two days of hearings were devoted exclusively to this subject earlier in this session of Congress. All members present at those hearings expressed a concern about the effect that office automation might have on the job security of Government employees. All members are ever mindful that to the fullest extent possible, employees should be protected from the impact of automation. The Post Office and Civil Service Committee will do all it can to encourage proper planning so that the benefits of automation can be fully realized by the Government at a minimum cost to loyal and valuable employees on Federal rolls.

Organized labor has expressed much concern about the impact of automation on employee job security. One example is the recent AFL–CIO Publication No. 21, "Labor Looks At Automation." Statements made in that report include:

> Automation promises to eliminate most routine, repetitive jobs. * * * But even in periods of high employment, the introduction of automatic machines means that some workers are likely to suffer layoffs, to be affected by changes in skill requirements or by job transfers. * * * For many skilled and semiskilled

workers, automation results in making their old skills obsolete and in a loss of job satisfaction. The new technology usually means the elimination of some jobs, downgrading some skill requirements and upgrading others. Academic assurances that all will work out well in the long run are of no help to the directly affected displaced or downgraded workers and their families.

It is gratifying to note that concern for the job security of experienced workers is apparently being shown in private businesses in connection with the adoption of large-scale electronic computers. In a recent study by the Bureau of Labor Statistics ("Experiences With the Introduction of Office Automation," Monthly Labor Review, April 1960), the following tentative conclusion was reached:

> About one-third of the employees in the office units directly affected by the change were shifted to other positions. Only a negligible number were laid off. The advanced planning that took place during the long preparatory period was useful in easing the impact of these changes. Such planning involved informing and consulting with employees and their organizations about the changes, establishing procedures for reassigning employees whose positions were being eliminated, and the minimizing of displacement through attrition and turnover. Since the introduction is a long continuing process, with new applications being made step by step, the full impact was not felt at the time the new equipment began to operate.

The BLS points out, however, that a few employees did suffer, and that promotional opportunities were limited:

> Those selected were chiefly men in their late twenties with some college education and some company experience in accounting and related work. Few women, older workers, or employees from the affected units were chosen for the newly created positions.

The General Accounting Office reported to the subcommittee that it had studied 17 locations where 31 computers had been installed. It found that although large numbers of employees were transferred to new duties, relatively few were deprived of employment. In most cases reassignment and normal employee attrition eliminated the need for reduction-in-force action. Increasing workload in some of the offices further minimized the layoff problem. There was considerable realinement of personnel and a significant amount of retraining for new duties. Usually personnel already in the affected program were selected for training.

Testimony given to the subcommittee by representatives of agencies having operations converted to electronic data-processing procedures reinforces the impression that the introduction of office automation into the Federal Government has not yet occasioned any disastrous personnel upheavals. But some employees have been adversely affected, and only careful planning has kept the numbers relatively small.

For an example of constructive advance planning, in a large-scale application involving complex interagency relations, the subcommittee commends the Treasury Department, the General Accounting Office, and the Federal Reserve banks for their accomplishment of the conversion to electronic data processing of the clearance, payment, and reconciliation of Government checks drawn on the Treasurer of the United States. According to evidence studied by the subcommittee, this conversion is yielding net annual savings of nearly $3 million and has reduced projected staffing requirements by nearly 800 employees. Advance planning in the mutual interest of the personnel and the Government, taking maximum advantage of transfer

opportunities and of normal attrition, took care of 753 people directly involved in the Office of the Treasurer and in the General Accounting Office without any resort to formal reduction-in-force procedures. The period of time required, from the beginning of the feasibility study in 1953 through the approval of the system plan in 1955 to the completion of the changeover to the new procedures at the beginning of fiscal 1959, was over 5 years.

Another commendable experience which has been reviewed in detail by the subcommittee has been that of the Veterans' Administration. In that organization, the first large-scale computer was installed in the Philadelphia district office in July 1959, to maintain insurance records for the more than 6 million policyholders. A second was installed in December 1959 at the data processing center at Hines, Ill. Smaller computers are being installed at other offices. Many of the VA's operations are being integrated and converted to these machines. With them, the massive paperwork of the VA can be handled more expeditiously, better services to veterans can be provided at lower cost, and the human resources of the agency can be utilized at a higher level.

In planning and carrying out the conversion, VA officials have tried to be careful to protect the job rights of their employees, using a set of procedures ordered by the Administrator himself. They include, first, advance planning at all management levels; second, determining at least 6 months in advance the occupational categories and number of employees affected; third, disseminating periodic information to employees about progress; fourth, making available to present VA employees the better job opportunities resulting from automation; fifth, initiating, well in advance, training programs for present employees; sixth, notifying employees who may be subject to adverse action at least 3 months prior to the possible action; seventh, freezing recruitment for at least 3 months prior to the effective date of the conversion to allow maximum transfer and placement possibilities within the VA for surplus employees.

Electronic data processing applications already scheduled in the VA will make more than 1,200 positions surplus. As a result of the procedures summarized above, virtually all of the incumbents affected to date have been placed, some of them in better jobs, in accordance with their qualifications.

As the trend to computers continues, the numbers of employees concerned will grow much larger, and the problems of assuring employee job security will be magnified. Procedures of the sort established and followed by the Veterans' Administration will need to be exercised by many more agencies. The Government centrally should encourage and facilitate the use of such procedures.

BRIEF DESCRIPTION OF SELECTED APPLICATIONS

The following section summarizes 12 applications which were selected to indicate some of the various uses being made of electronic data-processing equipment by Government departments and agencies. The material in this section was furnished on request of the subcommittee to provide informational background data.

Department of Commerce

Bureau of the Census

The world's first large scale electronic computing system for data processing, the Univac I, was delivered to the Bureau of the Census in April 1951, just as the tabulating load of the 1950 Censuses of Population, Housing, and Agriculture was reaching its peak. This system was capable of absorbing information from magnetic tape at the rate of 10,000 decimal digits per second, adding 11-digit numbers at the rate of 2,000 per second, comparing numbers in order to classify reports at a rate in excess of 1,000 per second, and recording the results on magnetic tape as fast as it could read in new data. Moreover, the central computer could be made to remember all the steps which had to be carried out in order to classify an individual's census report into all the many categories which were to be tabulated for small areas, and to carry out this sequence of steps automatically. But the auxiliary equipment which fed the data to the computer and the equipment which translated the results from magnetic tape to readable form were at that time no match for the computer in speed and reliability. Moreover, no one then had any real experience in using large scale electronic equipment on data compiling problems. In any event, although the Univac did handle what might be considered a large job when viewed alone, it processed only a part of the mammoth 1950 Census of Population and had very little effect on the number of people we hired, although it did help us to close out the job in a more orderly fashion because it began to take up more and more of the load as our temporary workers left the job.

By 1953, as the auxiliary equipment improved and our own experience increased, we began to use Univac more effectively on our current work. As you know, the Bureau of the Census is busy collecting a vast amount of statistical information even when it is not taking a population census. Each month we process sample information on retail and wholesale trade and on the employment status of our population, as well as on the foreign trade transactions of the United States, to name but a few of our current activities. We began to use Univac to tabulate our Current Business Survey, and our Current Population Survey, and took steps to apply it to our foreign trade statistics program. The use of this automatic equipment has not only enabled us to produce more timely statistics at lower cost, but has had the important effect of leveling off our requirements for clerical help.

A second Univac I was purchased, and both machines were used to process the results of the 1954 Censuses of Business and Manufactures, as well as the continuing current surveys.

We have recently added, also by outright purchase, two Univac 1105's which are now in operation at our Washington headquarters. Also we concluded arrangements with the University of North Carolina and the Armour Research Foundation under which, in return for Government assistance in defraying part of the purchase price of Univac 1105's compatible with the Census Bureau machines, each of these organizations has agreed to make available to the Bureau of the Census, during the period 1959 to 1961 when our requirements are at their peak, approximately two-thirds of the time available on the 1105 owned by the institution.

Thus, at present we operate six large-scale electronic data processing systems, four at our central headquarters and two others at locations away from home. Government engineers maintain our two 1105's while the manufacturer is maintaining our two Univac I's and will continue to do so until such time as we can expand our maintenance staff to take over these responsibilities. At each of the two locations away from home maintenance services are supplied by the educational institution. We reimburse them for our share of maintenance costs.

Another significant addition to our installation of electronic data processing equipment is Fosdic—film optical sensing device for input to computers. In a 1955 statement, when we were just beginning this development, we said:

> By the time of our next decennial census we expect that, again, automatic equipment will influence greatly not only how fast we do things but how we do them. We foresee equipment which can greatly reduce our requirements for a large staff of temporary employees to convert the information on schedules to holes in cards. In past decennial censuses we have employed several hundreds of such key punch operators. We are hopeful that in the future, there will be available equipment capable of reading marks placed on census schedules by our respondents or enumerators. Such equipment would eliminate the need for the large staff of key punch operatcrs for a short term job.

Our expectations of 1955 have been realized. Engineers at the National Bureau of Standards developed the basic principle involved in Fosdic. By controlling a beam in a cathode ray tube they were able precisely to scan microfilm images of census documents and detect whether or not marks appeared in specified locations on the image. With the assistance of census engineers appropriate control circuits and magnetic tape recording circuits were designed and reduced to a prototype machine by the NBS personnel. Subsequently four production models of this equipment were built by our laboratories. These machines are now in full time operation—24 hours a day 6 or 7 days a week—scanning microfilm copies of questionnaires filled out by the 1960 census enumerators and transcribing the information to magnetic tape.

Before attempting to provide some indication of the impact on employment at our Bureau of these electronic devices, attention should be called to two important ways in which the nature of our data processing workload in connection with the decennial censuses differs from what it was in 1950.

The first of these is that whereas in 1950 the census of agriculture was taken at the same time as the censuses of population and housing the current census of agriculture was taken separately beginning in

October 1959. The enumeration date for the 1960 Censuses of Population and Housing was April 1, 1960. Furthermore, the main part of the processing of the 1959 Census of Agriculture is being accomplished at an installation of punched card equipment in Parsons, Kans. The processing of the 1960 Censuses of Population and Housing is divided among, (*a*) offices at Jeffersonville, Ind., where the bulk of our clerical force for this work is employed and where we have the cameras which microphotograph the schedules, (*b*) our central headquarters where all of the Fosdic equipment and most of the electronic computers are located and (*c*) each of the two educational institutions previously mentioned.

Another important difference between 1950 and 1960 relates to sample information. The 1950 Census of Population included a basic list of questions asked of 100 percent of the population plus some additional questions asked of every fifth person. The 1960 census asks a shorter list of questions for 100 percent of the population, and most of the questions are asked of only every fourth household. In other words some questions that were 100 percent questions in 1950 are sample questions in 1960 and the sample was changed from 20 percent of the persons to 25 percent of the households. The net effect of these changes has been to reduce considerably the total amount of manual coding required for the 1960 census as compared with the 1950 census despite the increase in population from about 150 million to about 180 million. Coding is the conversion to a number code of descriptive information reported by an enumerator. for example, a person who is reported as an "ignition expert" in an auto repair shop must be assigned the code 472808 before we can classify him appropriately in the tabulations showing occupation and industry.

Obviously, our decisions relative to the timing of the census of agriculture and the allocations of questions between 100 percent and sample for the 1960 Censuses of Population and Housing were influenced by many considerations. With respect to the allocation of 1960 census questions between 100 percent and sample, however, the nature of our electronic data processing facilities was an important factor in the decision. With Fosdic's ability rapidly to convert intelligence recorded by a census enumerator to magnetic tape, plus the electronic computer's ability rapidly to tabulate, it became apparent that the tabulation and publication of basic population and housing characteristics could be expedited significantly if the 100-percent questions were limited to those which did not require manual coding. Where no coding is necessary the census schedules can be microfilmed immediately they are received at our processing office in Jeffersonville. This we are, in fact, now doing and we confidently expect that for the first time in our Nation's history the final official counts of the population of each State on the basis of which the seats in the House of Representatives will be apportioned will be the product of automated tabulations. Always in the previous 17 decennial censuses of our Nation these counts were obtained by hand because no mechanical method was fast enough to provide them to the time schedule specified in existing law. Furthermore, for the first time in our history the tabulations classifying the population by such basic characteristics as sex, age, race, and marital status will be available at the same time as the total counts.

The impact of electronic data processing equipment on employment in our Bureau can be measured roughly by comparing full-time staff at the time we were processing the 1950 censuses with our estimated full-time staff at the time we will be processing the 1960 censuses. Of course, the change in timing of the agriculture census and the other differences between 1950 and 1960 must be borne in mind in interpreting these comparisons. Another obviously important factor is the approximately 20 percent larger population in 1960 than in 1950.

Almost 10 years ago during the October to December quarter of 1950 our full-time staff working on the 17th Decennial Census reached a peak of approximately 9,500 employees. This decade we expect our full-time staff to reach its peak of approximately 4,000 employees during the July to September quarter of 1960. Thus, with a maximum staff only about 45 percent as large as it was 10 years ago we plan to process the census data for a population 20 percent larger than it was in 1950, and to publish the results much sooner than ever before.

Even more striking is a comparison between the two decades of the numbers of employees assigned to the tabulation operation. At the time of the 1950 censuses the staff of our Machine Tabulation Division, which included the key punch operators who converted information recorded on our schedules to holes in punched cards, rose from about 400 employees in the July to September quarter of 1949 to a peak of about 4,750 employees in the January to March quarter of 1951. This decade a roughly comparable staff is composed of our Machine Tabulation Division and our Electronic Systems Division plus the employees who operate the cameras which microphotograph the census schedules. This staff will increase from about 600 in the July to September quarter of 1959 to a peak of only about 750 in the July to September quarter of 1960. Whereas 10 years ago, in those parts of our Bureau directly concerned with what can be termed the mechanical tabulation of census results, the necessary recruitment and training and other problems attendant to a temporary increase in staff was measured in terms of over 4,000 employees, this time the comparable activities call for an increase only on the order of 150 employees. It is important to recognize that these comparisons do not mean that census employees have lost their jobs because of electronic data processing equipment. They simply indicate that we are able to discharge our responsibilities at decennial census time by adding smaller numbers of temporary employees.

Department of Defense

Army

FINANCE CENTER

Modern electronic computer equipment is revolutionizing operations at the Army's Finance Center. Operating almost "around the clock" the automatic data-processing system electronically maintains files containing over a million individual records and processes well over a million transactions each month. Recorded on magnetic tape these records contain financial information for every member of the Army regardless of where he or she is stationed around the world.

Known as the home of the Army dollar, the Finance Center, U.S. Army, is located at Fort Benjamin Harrison near Indianapolis, Ind. It is the point at which information concerning the pay of all Army personnel converges for processing, audit, and file. This is where the data pertaining to income tax withholdings and social security information is accumulated and payments made to the Treasurer of the United States. It is where all Army allotment checks are issued and mailed to families, banks, and insurance companies. The Finance Center also pays all Army retired personnel and pays for all transportation of individuals and equipment for the Departments of Defense, Army, and Air Force.

The Army's Finance Center is one of the largest accounting and data processing organizations in the United States. Long housed in makeshift quarters in St. Louis, it moved to Fort Harrison in October 1953 and now occupies a modern building which, among all Department of Defense buildings, is second in size only to the Pentagon. The construction covers an area of 14 acres.

The automatic data-processing system was installed in January 1958 and within a matter of days was paying its way. It consists of the main computer complex, four magnetic tape stations, equipment for reading and punching 80 column punchcards, and a separate facility for reading data from punched cards and recording it on magnetic tape. The accuracy and reliability of this system have been exceptional.

The first application placed on the computer was the maintenance of soldiers' deposits accounts for the entire Army. The soldiers' deposits system is a savings bank operated by the Army for the exclusive benefit of enlisted men. This was authorized by the Congress in 1872 to encourage thrift among the men who were garrisoning the West during the Indian wars and frontier days.

Nearly 200,000 soldiers all over the world have savings in trust with the Government at 4 percent simple interest under the soldiers' deposits legislation. Seventy-five thousand or more transactions every month must be entered in these accounts at the Center as soldiers add to their savings, receive partial or complete repayments, or close their accounts upon discharge. The automatic data processing system maintains a record for each individual account on magnetic tape similar to the tape used every day in office and home recording devices.

To properly administer these savings accounts the tape record must be brought up-to-date on a chronological basis. Also, the Finance Center is required to answer inquiries relating to the status of individual accounts. The system is programed so that the tape record is "searched" by the computer to ascertain such information. The computer also determines interest payable on closed accounts. The tape file is continuously rewritten as daily transactions alter the accounts. Information to answer inquiries and for issuance of checks to repay deposits and interest is provided as required. When a member's account is closed, and 8,000 accounts are closed during each month, the system furnishes a detailed record of savings, withdrawals, interest, etc.

The soldiers' deposits work was only the first of several applications placed on the computer system. The Finance Center must accumulate each month the amount of wages earned by each Army member. At the end of each 3-month period the cumulative wages for that

quarter must be reported to the Social Security Administration for posting to each individual's social security record. Individual wage earnings are now accumulated by the Center's computer system.

In this application the Finance Center pioneered in the exchange of data between two Federal agencies by means of magnetic tape. Ordinarily the wages would be reported by written listings containing almost a million lines of data or by sending quarterly nearly a million punched cards. Both of these means require expensive conversion procedures at the Social Security Administration before the information can be used. At the Finance Center all of this information is recorded on approximately 60 reels of magnetic tape which are sent to the Social Security Administration each quarter. Each reel of tape contains wage earnings for over 15,000 personnel. The tapes can be immediately used by the Social Security Administration's automatic data processing system to automatically update each member's account. This is done without human intervention. This saves that agency thousands of dollars each year and is an outstanding example of what cooperation between Government agencies can accomplish in this rapidly developing field of data processing.

When larger equipment is installed next year the Finance Center is planning a similar exchange of data with the U.S. Treasury Department. In this case the check number and dollar amount of each of the 600,000 Army allotment checks issued each month will be reported to the Treasury on magnetic tape for immediate entry into that agency's electronic computer system. Again, this will not benefit the Army directly but will save the Treasury many thousands of taxpayers' dollars in meeting its reconciliation requirements.

Army members may authorize a portion of their pay as an allotment to be sent each month to their families, to banks, to insurance companies, or to be used to buy U.S. savings bonds. Thus each member is assured his obligations will be met and his family will receive their money regardless of the world situation. The Finance Center makes the authorized payments and the local Army finance officers located around the world deduct the allotments from the individual's pay. It is essential that the Finance Center pay only the amount actually deducted. Accordingly, the worldwide deductions from the pay of almost a million persons for over 1,400,000 individual allotments are reconciled with the corresponding payments made by the Finance Center. This tremendous job is being performed by the automatic data-processing system at electronic speeds.

Still another application is the accumulation and analysis of statistical data concerning pay to Army personnel. The information is used to support the budget for pay of the Army which is presented to the Congress each year.

With all of these major workload increments added, the use of the currently installed automatic data-processing system increased until a three-shift round-the-clock operation was reached. To make further progress the Finance Center would need a larger system with greater capabilities and even faster speeds. In 1959 a comprehensive study was initiated to determine the most desirable large-size computer system for existing and additional Finance Center applications. The study resulted in recommendations for procurement of a new higher capacity system which will be installed during 1961 to replace the present system.

In addition to the present applications, the new equipment will be used to maintain the 1,400,000 individual allotment accounts, process approximately 180,000 changes to these accounts each month, print more than 600,000 U.S. Treasury checks each month, and print an average of 200,000 U.S. savings bonds each month. It will also eventually be used to maintain the growing number of pay accounts of retired Army personnel and print the monthly retired paychecks now numbering approximately 100,000. Certain transportation disbursing and accounting functions are also scheduled for conversion to the computer. Use of the new system is expected to greatly increase accuracy and efficiency in all of these areas.

Special recognition is now being given to the tremendously expensive task of converting data supplied on various forms and documents into punched cards for machine processing. Until recently the universally accepted method of accomplishing this has been for machine operators to read the documents and punch the information into cards. This becomes more expensive each year as the cost of manpower ever increases. The Finance Center is now actively pursuing means of reducing this tedious, manual, costly effort.

The first possibility is the creation of punched cards or punched paper tape as byproducts of the mechanical procedures which will be used by Army finance offices throughout the world to compute pay. Such byproducts can be mailed to the Finance Center and used immediately in the automatic data processing system. This procedure has been extensively tested and in two areas has already been adopted as a regular operating procedure.

A second potential for reducing the cost of converting data to machine language is the use of optical character recognition equipment. Machines have been developed which can actually "read" a typewritten document and record the information they read onto magnetic tape. The Finance Center is actively studying the possible use of such machines. The principal difficulty is that all documents must be typed with the same size and style of type. Since the documents received at the Finance Center are originally prepared in many offices throughout the Army this presents a major standardization problem in the effective use of optical character recognition equipment at this time.

The Finance Center has also made progress in mechanizing some of its operations which are not applicable to automatic data processing systems. Almost a million military pay vouchers are received each month. These are individual statements of account for each Army member and represent receipts to show that pay was actually received. The vouchers must be sorted and filed in individual folders. Modern Keytronic sorting machines have been installed to do this tremendous job. When the operator depresses a single key the machine automatically places the voucher in the proper pocket. Installation of 10 of these machines has made it possible to sort approximately 55,000 military pay vouchers each workday.

Microfilming techniques are used extensively to reduce the tremendous bulk of documents which must be filed at the Finance Center. Microfilm also makes reference to documents faster and easier. Punchcard high-speed tabulating equipment has been in use for years and recently equipment such as punched paper tape

activated typewriters have been used to prepare individual collection letters to persons indebted to the Army.

BALLISTIC RESEARCH LABORATORIES

The primary mission of the Computing Laboratory is to prepare firing tables for artillery, small arms, aircraft, mortar, rocket, and guided-missile weapon systems and to assist other laboratories of the Ballistic Research Laboratories at Aberdeen Proving Ground, Md., and outside agencies in the solution of mathematical problems arising in their various fields. Mathematical and engineering research both to develop new and better numerical procedures and to improve the performance of the BRL high-speed digital computing machines has become an essential function of the Computing Laboratory.

The rapid development of high-speed electronic digital computers has naturally led to a reevaluation of the numerical procedures formerly used for the solution of mathematical problems on desk calculators. Many slowly converging iteration schemes are unsuited for hand computation. However, they may be applied most economically to the solution of problems on a high-speed digital computer because it can carry out a large number of operations in a short period of time. Error estimates of integration and differentiation procedures become of primary importance because even very small round-off errors may be magnified after millions of operations to such an extent that they completely obscure the real result. Thus, numerical analysis has become a branch of mathematics which is of primary importance not only to the mathematician, but also to the physicist and engineer who wants to obtain numerical solutions to his problems.

As the capacity of the high-speed computing machines to handle complex problems increases, many very little explored areas of research in numerical analysis gain in their significance. The numerical solution of partial differential equations, numerical investigations of nonlinear problems and the application of Monte Carlo techniques to simulate complex events such as the engagement of a bomber by a guided missile or the simulation of a battle are but a few examples of this kind. The continuous evaluation and study of new engineering developments such as the use of ferroelectric materials as computer components is a necessity for any organization which wants to keep abreast of the field.

Research toward a more efficient organization of a high-speed digital computer itself becomes of more and more importance as the complexity of these devices increases. Even some relatively simple problems such as the optimum size of a high-speed memory of a given speed in comparison to an arithmetic unit and additional memory capacity of slower speed are still awaiting a satisfactory solution. The question of an optimum instruction code for a high-speed digital computer has not yet been satisfactorily resolved.

There are many problems which have to be solved by guessing an answer because no mathematical model for their solution has yet been developed. This problem, in many instances, is an especially difficult one because the mathematical model must consist of a sequence of the four basic arithmetic operations (addition, subtraction, multiplication, division) plus a number of yes or no decisions in order to be solvable by a high-speed digital computer. The selection of a proper mathe-

matical model is of extreme importance in the solution of any engineering problem. While a poor mathematical model may make the numerical solution either impractical or even impossible because it would take even a high-speed digital computer hundreds of days to obtain an answer, a well-chosen procedure may cut the computing time by a factor of a hundred or even more. As an example, the solution of a system of 20 linear equations in 20 unknowns by the method of Cramer taught in all colleges, would require about 30 billion years of computation on a high-speed digital computer, while the same problem can be solved in less than 10 minutes by using methods developed by research in numerical analysis during the past few years.

During 1959 approximately 15,000 hours of ORDVAC (ordnance variable automatic computer) and EDVAC (electronic discrete variable automatic computer) time were used, an average of 141 hours per week per machine. Calculations were performed and programs were prepared for problems originating in all parts of the BRL. The following topics have been selected to give some indication of the general nature of the work done:

Interior ballistics: Projectile, propellant, and launcher behavior; characteristics of solid propellants; equilibrium composition and thermo-dynamic properties of propellants; characteristics of detonation and shock-wave reflection; vibrations of gun barrels; and flows in porous media.

Exterior ballistics: Wind tunnel and spark range data reduction.

Terminal ballistics: Effects of fragmentation and penetration of shape charges; ignition and heat transfer problems; explosive kinetics.

Ballistic measurements: Reduction of data for satellite doppler tracking; photogrammetry; ionospheric measurements; and calculations of damping of satellite spin.

Weapon systems: Evaluations of antiaircraft and antimissile systems; lethal areas and kill probabilities; war-gaming studies.

Firing tables: Computations for artillery, mortars, rockets, and guided-missile systems.

The Computing Laboratory has continued to provide support services in the measurement and graphical presentation of test data. A wide variety of BRL projects have been completed ranging from blast loading effects to upper atmosphere research, and projectile fragmentation to radiation shielding.

Navy

ELECTRONICS SUPPLY OFFICE

North of Chicago on the shores of Lake Michigan, an inland shore-based Naval installation is daily gaining prominence in a rapidly changing space age. This activity, the Electronics Supply Office with a computer that was installed in May 1958, is today managing Navy's electronics repair parts program with comparative ease.

To give the reader some idea of the vastness of the data processing job the Electronic Supply Office is required to do—there are about 1,100,000 items of supply carried at 24 stocking activities for which inventory records are maintained. This requires an inventory investment of $200 million. Approximately 140,000 transactions

each week affect the inventory records of this huge monetary investment.

The Electronic Supply Office is reponsible for identification, cataloging, provisioning, procurement, allocation, and replenishment of systems and activity stock levels for material under its control. Further, the ESO repositions stock as needed, performs technical reviews to achieve standardization of items of supply, and numerous other inventory management functions.

In preparation for the installation of the computer, it was recognized that the full improvement potential could not be realized if the computer merely replaced personnel and equipment in doing the same work. Rather it became increasingly evident that the predominant value to be obtained was the opportunity to apply new techniques and develop completely new procedures designed to take full advantage of an extremely fast and versatile tool. As an example of this, prior to installing the computer, electronic repair parts inventories were controlled by a requirement for stock status reports submitted to the Electronics Supply Office once each quarter by 24 stocking activities dispersed over a wide geographical area.

With a 90-day interval between reports, current supply intelligence was available only for the first few days after the report was received. However, subsequent to the installation of the computer which provided the capability and capacity to handle large volumes of data accurately and expeditiously, the method of furnishing stock status information was changed to daily transaction reporting which provides immediate continuing intelligence to the inventory manager on the status of each individual item of supply at each stocking activity. This more timely supply management information system permitted a reduction in supply inventories which is estimated to be a one-time saving of $4 million. Moreover, it is estimated that an intangible saving of $600,000 per annum through reduced holding costs has also been realized.

In addition to increasing supply effectiveness, availability of a computer has made it possible for the Electronics Supply Office to apply the fruits of operations research on advanced inventory control techniques, such as the Stanford Research Institute mathematical model for advanced stock control procedures. The objective of this model is to maximize supply effectiveness within any given dollar allowance by using mathematical formulas in making three principal types of supply decisions; that is, procurement, allocation, and redistribution. These formulas describe relationships among such factors as demand, demand variation, economic order quantities, cost of ordering and holding, procurement leadtime, leadtime variations, and item essentiality. Because of the complexity of the required computations, the use of a high-speed computer is essential to the application of this model. Pilot computer runs have been made and although the evaluation has not been completed, preliminary results have been encouraging and the expectations are that considerable advantage will be gained through use of these advanced methods.

Although the full benefits of computer operations have yet to be realized, the installation at the Navy's Electronic Supply Office has demonstrated to the Navy that such equipment will contribute to a more effective supply system, will reduce inventory costs, and will provide the ability to handle peak workloads without proportionate increase in cost, staffing, or elapsed time.

MANPOWER INFORMATION SYSTEM

There are now more than 600,000 military personnel on full-time active duty aboard naval vessels all over the world, and naval installations from border to border, coast to coast, and across the globe.

Eleven of our States have a population less than or equal to this number. Responsibility for administering the Navy's large personnel program is in the Bureau of Naval Personnel. Here are determined such things as how many people with what skills are needed; where they are needed; how many are now on board; who they are and where they are. Here the many and important policies, plans, and decisions on recruitment, training, assignment, feeding, housing, clothing, transportation, welfare, discipline, and final release of uniformed personnel are made. To do the job well requires complete, current, and accurate information on the individuals who make up the nuclear age Navy. This information, in huge volume, in many forms, is useful to and used by many echelons inside and outside the Navy.

Gathering, handling, storing, and passing this information on to others is a major, continuous, and ever-growing job. Until recently this was largely accomplished by batteries of clerical personnel, aided by typewriters, adding machines, and a large number of punched card equipments.

While this was satisfactory in the past, it became an increasingly inadequate way to meet the personnel administration needs of the modern, farflung, fast-moving, and highly technical Navy.

In 1956, the Chief of the Bureau of Naval Personnel announced a long-range plan for the use of electronic data-processing machinery in naval personnel administration. The goal was to harness the accuracy and quick-as-light speed of the electron to an improved system capable of giving Navy the information about its people upon which correct and more timely and equitable decisions could be made.

Realizing that, despite its many-splendored wonders, the electronic marvel could not make any improvements by itself, the Bureau decided to take a complete and fresh look at the whole system of personnel administration. Whatever the eventual use of the hardware, what was needed was a smooth running, single system of diverse but well-integrated parts. This indicated a three-stage effort: First, the analysis of all personnel functions; second, evaluation of the characteristics and capabilities of all data-processing machines; and, third, the education and training of personnel.

Preliminary study isolated 16 basic personnel functions, from the first task of determining the required quality and quantity of people to meet the needs of the modern Navy, through the tasks of getting, testing, training, and assigning the right man to the right job, to the final release of individual from active service. Fundamental to all these functions was the need to have a great deal of information about many people, in many places, in many forms, and in time to be useful.

After months of intense and massive reappraisal, a system was designed to gather data on naval personnel anywhere in the world, process this data in field commands and in Washington, D.C., and provide the finished information to anybody needing it, when they needed it. The heart of this system was a number of strategically located data-processing installations. Three major manpower data-processing installations were established—one on the east coast to

serve the Atlantic Fleet; one on the west coast to serve the Pacific Fleet; and one to serve units in the continental United States. Each would account for personnel in their respective areas and all would be tied to each other and to the hub of the system at headquarters in the District of Columbia by a communication network.

These units collect, maintain, and process over 60 items of information about each enlisted person and about 200 items about each officer, ranging from such static things as name and serial number to such changing items as qualifications and assignment. Much of this information is on reels of magnetic tape, each of which can hold 5½ million numbers or letters of the alphabet. To hold this much data in punched cards would require a stack of these cards 40 feet high. All these numbers and letters can be run through machines in 6½ minutes. Information can be rapidly exchanged between the Bureau, the Pacific and Atlantic Fleets and the continental manpower data processing installation.

The present naval manpower information system, though still young and not fully implemented, is an integrated, Navy-wide information service. It is designed to gather, process, and disseminate information needed for management of personnel. Its goals have been and are to achieve better and longer range advanced planning, faster distribution of personnel, reduction in the number of people in transit between assignments, better coordination among commands, the better fitting of man to job, greater personal attention to individual needs, higher morale, and finally, a stronger fleet.

Increases in speed and accuracy and usefulness of reports have been dramatic. The electronic machines handle more information faster, and with almost total elimination of errors. Duplication and repetition have been eliminated. Reports previously requiring days and weeks are finished in hours. Information which used to be mainly of historical interest is now up to date and ready when called for. Large backlogs have been cut. There is quicker response to the needs of individuals and the fleet. There are plans for the machines to handle an increasing portion of the data-processing workload, and to further use the machines in decisionmaking, planning, and forecasting.

As the Bureau of Naval Personnel carried out its plans for mechanization, there were fears that the personal and human touch would be lost. The heartless hardware would only remember and treat people as numbers. Nobody wanted his welfare and career entrusted to a mass of mysterious wires and blinking lights, no matter how fast the mechanisms or antiseptic the environment. These fears have proved groundless. The needs of the individual have not been forgotten or lost. In fact, with more complete, accurate, and timely information on each person now available for study by managers, more specific attention can be given to each individual. In the words of the Bureau of Naval Personnel, a prime goal, now attainable, is to get the closest thing to a personal interview without the actual presence of the individual.

Air Force

ENGINE MANAGEMENT SYSTEM

The scope of Air Force operations and the complexity of modern air weapons create formidable demands upon the management of materiel support activities. Outstanding among these requirements is the need for highly effective management of air vehicle engines, which are vital to performance of the Air Force mission. Today, this task is being supported through the practical application of automatic data-processing equipment.

An engine data-processing center for the Air Force has been established at Oklahoma City Air Materiel Area. A centralized record is maintained indicating by serial number all facts required for engine management. These data include information concerning location, condition, hours since last overhaul, shipment, cause of removal, parts causing failure, installation, configuration, etc. These records are updated by direct reporting on an "as happens" basis from bases and/or contractors to this centralized location. From these data, information is furnished to engine managers to support all phases of management, the most significant of which are the ability to pinpoint problem areas within each major segment of the pipeline and the ability to automatically resupply engines.

The fundamentals of engine management, which are interacting, cover the complete gamut of logistics: requirements computations, budgeting, buying, distribution, transportation, overhaul, inventory control, and disposal. Simply stated, these are:

Requirements computation—are basically the application of data and factors to official USAF programs to determine the number of engines that must be available to support the projected program.

Budgeting—a statement of engine requirements expressed in quantities and dollars must be submitted through various reviewing agencies to the President for inclusion in his budget presentation to Congress.

Buying—procurement directives, within the limitation of the funds appropriated by the Congress, are issued and contracts are negotiated.

Distribution—having the correct quantity in the hands of the user when he needs them.

Transportation—involves the movement by whatever means necessary (air, rail, water) to insure their timely delivery to the user.

Overhaul—the scheduling of unserviceable engines for overhaul and return to service in order to meet the program.

Inventory control—is knowing the "where, what, when, and how" of all engine assets.

Disposal—the last, but by no means the least, is the removal of engines from the Air Force system when they are no longer needed.

Scope

Today the management of engines is the biggest single business within the vast complex of big businesses that make up the Air Force logistic system. Keeping track of more than 100,000 engines worth $6 billion, located at about 900 different locations throughout the world, is a formidable challenge. The size and scope of this business with its monetary and mission impact is the primary reason for the development of an integrated logistic system pioneering many of the principles of selective management.

Back in the period of fiscal year 1950–51 we were buying more spare engines than installed—for every four engines installed in aircraft we were buying about five spares to support them. Today the overall trend is closer to one spare engine for every four installed engines; and this despite world conditions that have imposed new obligations upon engine managers to insure support in case of war, an influence that might well have been expected to boost dollar outlay had not aggressive management action been instituted to offset this influence.

Prior to electronic data processing

Over the past, various data systems had been employed including serial number control. The inventory system replaced by electronic data processing called for five separate reporting forms to be maintained and processed by various reporting activities. These were the aircraft engine history, engine history change, engine status change report, engine inventory report, and installed engine report.

All of these forms were maintained at the reporting activities and consolidated at the end of each month for submission to the three prime engine air materiel areas (San Antonio AMA, Oklahoma City AMA, Middletown AMA). These AMA's, in turn submitted a summary report for their engines to Headquarters, Air Materiel Command for consolidation and submission to Headquarters, USAF. Sixty to ninety days would elapse before a finished product was available for management use.

Electronic data processing

With the advent of automatic data-processing equipment, an entirely new approach was taken. It made possible centralized serial number control of all engines within the Air Force by direct reporting to the computer. The first step was to determine essential elements of data that are necessary for an engine manager at all echelons of management (Headquarters, USAF, Headquarters, AMC, and other major air commands, AF bases and appropriate contractors). These elements consisted of the following:

How many engines by location and condition (serviceable—reparable)?
How many engines are in transit to where?
How many reparables generate for field maintenance?
How many reparables generate for major overhaul?
How many engines are in overhaul?
How many engines are produced from overhaul?
How many engines are out of commission for parts?
How many engines require technical order compliance and where are they located?
How many engines were gains to inventory?
How many engines were losses to inventory?
How many actual hours were flown?
What items caused the engine to fail?

From the above effort emerged the present integrated engine management system. Available now at Oklahoma City AMA, on magnetic tape, is an inventory record by type, model, and series showing serial number, location, and condition (installed, serviceable, or reparable) of approximately 100,000 engines. This master record is updated daily, indicating the removals, installations, and movements by direct reporting from using activities to the data center

on an "as happens" basis (7,000 reports daily). In addition, material deficiency and engine configuration data are available; however, these tapes are updated weekly. From these centralized collected data, management reports are furnished to all echelons of command. This information consists of:

Inventory reports portraying location, condition (installed, serviceable, or reparable), quantities built up for engine changes and those requiring maintenance. Summaries are prepared to provide a basis for establishing procedures for more efficient management of overall assets.

Pipeline reports make data available on the actual and average number of days that engines remain in segments of the pipeline, such as base supply, field repair, in transit, and major overhaul. Pipeline information is probably the most significant byproduct evolving from the system to date for managers at all levels, across all functions. Transportation managers are now reviewing data allowing them to analyze past movements, time in transit, and modes of shipment. This is the basis for forecasting future movements for better overall management. These types of reports enable management to make comparisons and evaluate performance of individual bases and commands.

Actuarial compilations similar to those used by life insurance companies are the means of constructing failure tables for use in projecting engine removals and analyzing maintenance problems. The procedures, very complex and repetitive in nature, adapt very well to electronic computers. Failure rates are computed for each major engine-aircraft combination and are used to pinpoint trouble areas, such as early failures and abnormally high removals.

A configuration accounting system is presently being maintained to determine the "current capability" of each engine within the Air Force by serial number. "Current capability" means the modification changes that have been accomplished in order to effect better engine performance. These modifications are known as technical order compliance. The accomplishment of a modification required by technical order may affect the service life, ease of maintenance, operational characteristics, and spare parts requirements. The objective of this program is to create a current record on the accomplishment or nonaccomplishment of TO's by engine serial number to aid in determining spare parts requirements and in scheduling engines for modification.

A material deficiency reporting system has been incorporated into the overall management package. Control chart techniques are used to identify out-of-control conditions and information pertaining to valid problem areas only is furnished. These data are used to develop engineering fixes, failure trends, and spare parts usage factors.

An automatic resupply program for aircraft engines has been initiated. A feature of this program is the ability to signal each time the user stock level falls below a predetermined level, so that when an engine is removed from an aircraft for overhaul, a serviceable engine is shipped to take its place without the user submitting a requisition. The implementation of automatic resupply is actively being pursued, as it represents a big payoff for electronic data processing. Advantages over the old system include:

Adequate base stockage levels with fewer engines.

Excesses and shortages occur less frequently due to closer control and faster replacement action.

Replacement requirements are based on actual changes rather than projections.

Replacement engine pipeline time is reduced from 45 days or longer to less than 20 days.

Administrative efforts are reduced.

There is less redistribution of engine assets between bases.

Benefits

The continuing concentration of considerable management effort and tailored systems to this vital and costly area has paid off in terms of "more support for less money." Current information is now available to make management decisions in contrast to the previous delay of 60 to 90 days. For example, the Continental Air Command, upon completion of its implementation of the automatic resupply program, reported a total of 113 fewer engines required for base stock level pipeline. This resulted in a reduction of nearly $3.4 million in their engine inventory. By closely monitoring "in transit engines," it has been possible to reduce this time from approximately 12 days to 4 days. For a past aircraft program, a substantial portion of the $113 million engine reduction was attributable to the fact that actual, up-to-date removal factors could rapidly be developed. In addition, the capability of maintaining close management of all engine assets makes it possible to determine at a much earlier date the engines that will be in long supply. These engines can then be reclaimed for spare parts which, in turn, reduces the spare parts procurements by considerable sums.

In summary, this is a major data systems development effort utilizing special management techniques in order that the strictest possible control of these expensive items can be exercised at all management levels.

LEASED COMMUNICATIONS PROGRAM

The Air Defense Command, headquartered at Ent AFB in Colorado Springs, Colo., probably occupies the unique position of being the largest single customer of the giant telephone industry. The very nature of air defense in the supersonic age demands that a highly sophisticated and intricate network of communicative capability be employed to coordinate the use of weapons and personnel resources to insure success in any future air battle that might ensue.

Since 1953, Headquarters, ADC, has been delegated the responsibility for administrative support of the communications warning network for North America. At that time, the manual (A.C. & W.) system was growing steadily and the semiautomatic ground environment (SAGE) system was in its infancy. The operational cost of the (A.C. & W.) system in fiscal year 1954 was $9 million and the administrative support cost was correspondingly low.

Growth of the communications network soon outstripped the ability of the support personnel utilizing manual clerical methods to provide the necessary administrative support in an effective manner. In 1956, conventional punchcard accounting machine methods were adopted to effect bill paying, accounting procedures and reports to the operat-

ing divisions, to Headquarters, ADC, components, to USAF, to the General Accounting Office and the Air Force Finance Center.

Within a year, it was evident that the adaptation of punchcard accounting machine methods was paying off in more accurate program estimates, in happier telephone company relations, and in more accurate, timely, and effective control of the programs.

As the air defense posture became further strengthened and more sophisticated, a concomitant result was a greatly expanded and complex communications network developing at an accelerated rate of growth.

Soon it became evident that the punchcard accounting machine methods employed to accomplish the administrative tasks could not respond with an acceptable level of support. Thus, in the fall of 1958, the decision was made to exploit the greater potential of electronic data processing to more effectively accomplish and manage the administrative facets of the leased communications program. Among the more salient problem areas which confronts the manager are the determination of requirements, preparation of a budget, procurement, accounting and disbursement, and system evaluation.

An important consideration which justifies the use of a computer in a given application is that certain economies in personnel and equipment resources can be achieved. The Air Defense Command did most certainly anticipate a realization of direct savings; however, the primary motivation to apply computer techniques to the leased communications application was the fact that other methods had little chance of success in handling the rapidly expanding support load.

The magnitude of the contemporary program very nearly approaches 1 million stored records against which almost one-half million changes are processed annually. The fiscal year 1960 financial plan anticipated expenditures in excess of $43 million.

The underlying philosophy of the total system design is to integrate, to the maximum extent feasible, the multiple but interrelated problems areas previously mentioned.

While the total system is still being developed, both productwise and in the EDP programing area, the contemporary products produced contribute significantly toward solution of the managers problems areas. Budget estimates are prepared for the current and succeeding 2 fiscal years. These computations are developed from records maintained on the installed and ordered services plus recognizance of the planned circuit requirements.

Also prepared are the annual financial plans and the revisions as may be appropriate. The basis for calculation is the same as for budgets. Equally important to management is an auxiliary report prepared periodically as desired on the progress of the financial programs. Portrayed are projected obligations adjusted for actual performance as we progress through timely reprograming action as dictated by the current circumstances.

The computer produces CSA listings (communications service authorizations) which become the body of procurement documents for telephone company services. The CSA files are now maintained on a current basis because of the rapidity of processing changes automatically. Termination liability accounting can now become realistic, insuring ADC's ability to refrain from exceeding the termination liability ceiling set by Congress. Detailed descriptions of services

are now being prepared furnishing historical data and bill verification data heretofore impossible to obtain.

Prompt and accurate payment to the telephone industry is a major concern if harmonious relations are to be maintained and enjoyed. Obligation and expenditure accounting is provided, as is identification of invalid obligations. Each bill presented by the telephone industry is automatically checked against the computer stored records of the contract. If the billing does not possess the programing validity check, payment to the billing telephone company is refused. In the event that all validity checks are met, the payment to be made is entered on a disbursement voucher, accounting records are adjusted, and an historical record of payment is created. Checks can and have been prepared automatically; however, current volume does not warrant mechanical preparation.

Evaluation is an important element of any managers responsibility—currently several management reports are prepared to facilitate this analysis of data and evaluation of the leased communications program.

1. *Bill paying research list.*—Purpose is to segregate those items submitted to the computer for processing (bills, A/P additions, A/P deletions, refunds, collection notices) into two groups: Group I, items which are to be subvouchered in preparation for checkwriting; group II, items to be returned for additional research before processing. Additionally, this list provides status of the allotment ledger after bill paying as it pertains to 3 fiscal years and to the lapsed account plus other analytical data.

2. *SAGE, CSA list.*—Purpose is to provide a detailed list of the services or facilities that are to be ordered. The DD Form 428 is attached and list is incorporated into the CSA by approved wording.

3. *Manual CSA list.*—Purpose is to provide a record of the A.C. & W., CSA prior to and after a given supplement has been incorporated into the computer records as a result of one processing run. Provides an accurate check on the data the computer compiles as the result of an order or CSA action.

4. *Manual line item budget analysis.*—Purpose is to provide a budget analysis of the transactions processed into the manual line item files. It explains the increases or decreases to budget requirements, by reason, within program and subprogram, from processing date to the end of the fiscal year.

5. *Expenditure history report.*—Purpose is to show those items placed in the expenditure history file as the result of a bill payment processing run. It provides a valuable tool for duplicate payment control and facilitates payment research.

6. *Variance history report.*—Purpose is to give to the manager a complete listing of each accounts payable record that has been paid under the variance procedure. This is used by the disbursing and accounting group to take necessary action to reduce outstanding variances to a minimum.

7. *Bills register.*—Provides a history of financial transactions against each CSA for the current fiscal year. Data on this list includes all expenditures, all accounts payable outstanding and the current in-service summary record of each active CSA. Provides a ready reference for bill paying actions and permits easy access to those accounts requiring attention or corrective action.

8. *Accounts payable aging report.*—Used as a control to eliminate delinquent billing by the telephone companies.

9. *Expenditure analysis report.*—Shows the average number of days taken by the telephone companies for billing and the average number of days taken by ADC for payment action. This is a valuable report often exposing inaccurate telephone company claims of delinquent bill paying action as compared to billing action by same telephone company.

10. *Budget and financial plan report.*—Provides the budgeting and programing function within C. & E. an accurate report reflecting both the obligations to date and programed requirements for the current fiscal year and a forecast of budget requirements for the next 2 fiscal years.

11. *Manual inventory of services list.*—Provides Headquarters ADC, and subordinate units with an accurate listing of all services and facilities that have been programed, ordered or are in service. Used by subordinate units as a means of verifying what has been programed for a specific unit and what changes or disconnect actions are required to accomplish the assigned mission within approved operational plans.

12. *Manual slippage report.*—Provides an accurate listing of all manual line item requirements and ordered items whose installation date was 30 days or more prior to the month of the report and for which we have not received charge detail sheets. This report also lists items which are ordered to be placed in service within the next 60 days and is used to query the telephone company involved for charge detail sheets ahead of time.

Approximately 1 year has transpired since the initial phases of the application were placed on the computer. An examination and evaluation of the operating experiences to date has confirmed the wisdom of the earlier decision to apply computer techniques to the support task.

A stated objective of the application was to develop more complete and accurate fiscal planning. Review of historical data, prior to the computer application, indicates the initial fiscal year 1959 financial plan of more than $39 million exceeded year-end obligations by $8 million. This represents an overstatement of requirements by approximately 21 percent.

Examination of the latest available data indicates the objective of better fiscal planning has been met. The current fiscal year financial plan when compared with actual and projected obligations reflects a threefold improvement in planning accuracy.

Another stated objective was to increase the speed of paying accrued obligations. Prior to EDP, disbursements amounted to approximately 50 percent of the obligations.

Again the objective has been met and the current ratio of disbursements versus obligations approximates 64 percent. The speed of processing actual data after receipt by the computer is of course faster than conventional method, but computer preparation of vouchers and associated fiscal documentation considerably increased bill payment speed. Any research required because of bill reject action is accomplished by reference to the error listing which specifically points to the source of difficulty and reason for reject.

Conversion to EDP of the leased communication application resulted in a reduced requirement for conventional punchcard accounting machines approximating $130,000 in annual prime shift rental costs and 29 personnel. More significant is perhaps the impact upon the system managers support requirements. On July 1, 1959, taking into consideration only the budgeting and financial planning activities, the contracting activities, and the financial services activities, this organization was managing and supervising in fiscal year 1959 a program of $30.7 million. In fiscal year 1960, the program is $51.1 million. This program will continue to increase to an estimated cost in fiscal year 1961 of $86.7 million. It has been estimated that this program will continue to increase until it reaches a leveling-off area in fiscal year 1964 of approximately $139.4 million. Related to the increased cost of the program will be a concurrent increase in the activities for the budgeting, the number of contracts issued and maintained by this organization. These increases should be, to a degree, proportionate to the increase in program cost. As presently foreseen, this increased workload can be absorbed by the organization without any significant change in personnel authorization because the vast amount of this increased workload will be performed by the EDP system. In evaluating the computer effectiveness, consideration must be given to the number of individuals required to carry out this increased work had it been necessary to continue operations under the former punchcard machine and manual systems. Even if it had been possible to obtain an increased authorization to perform these tasks under the punchcard machine and manual methods of operation, one efficiency factor that should be recognized is that each card entry into the punchcard machine system is a potential source of human error. The reject capability built into the computer operation has, to a large extent, provided a degree of insurance against these potential errors, thereby providing a means of operating efficiency and accuracy that is of immeasurable value.

Concomitant with the reduced personnel requirement is the reduced requirement in floorspace to house the staff. It is estimated that the contemporary mode of operation results in a savings of approximately 2,700 square feet. Local leasing and maintenance costs in the Colorado Springs, Colo., locale of $4 per square foot over a 12-month period, equates to $10,800 annually.

To reiterate, the decision to exploit computer capability to support the huge support task for the leased communication program was indeed a wise choice.

Department of Health, Education and Welfare

Social Security Administration

Bureau of Old-Age and Survivors Insurance

1. *Background and preliminary study*

Members of the staff of the Bureau of Old-Age and Survivors Insurance followed very closely the developments in the field of electronic data processing equipment from the time the first electronic computers were announced after World War II. Studies made in 1951 with the assistance of staff from the National Bureau of Standards

resulted in a conclusion that the electronic equipment then available could not be economically utilized in the Bureau's large-scale record keeping operations. Bureau staff, however, continued to watch developments very closely so that they would be in a position to determine when new or improved types of equipment might change the conclusions reached in 1951.

The 1954 amendments to the Social Security Act brought about a more intensive study of the possibilities of using electronic data processing equipment. These amendments required the Bureau to maintain in mechanically retrievable form the annual earnings for each individual covered by the social security program so that these annual earnings could be used in computing the amount of monthly benefits when a claim for benefits was filed. Because of the limited capacity of punched cards, the need to retain annual earnings data would have made it necessary by 1956 to prepare second cards for the approximately 117 million accounts which were then in file. This would have required the expenditure of about $350,000 for additional file cabinets, as well as a continuing expenditure of about $250,000 annually for the extra manpower and machinery which would be necessary to handle two cards per account instead of one.

Bureau staff saw in electronic data processing equipment a possible means of avoiding the procedural complications and expense which would have been entailed in establishing this second card file. Accordingly, it was decided to conduct a full scale feasibility study with the objective of trying to reach conclusions early enough to obtain the necessary equipment and install the new process by July 1, 1956. In November of 1954, six management analysts were assigned to this study, four on a full time basis and two in a consulting capacity. It was decided to study initially two of the major record keeping operations of the Bureau, first the annual updating of individual earnings records and second, the investigation and identification of earnings items reported with incorrect social security account numbers. With respect to the latter, prior studies had indicated that more than 80 percent of the items reported incorrectly by employers or by self-employed individuals were incorrect on only one digit or by transposition of two adjacent digits. It was felt that it should be possible to discover the correct account numbers for most of these by means of electronic searching methods.

After several months of intensive study and problem definition, a statement defining these two major applications, as well as defining the requirements for conversion from existing punchcard processes, was prepared and sent to 11 manufacturers of electronic data processing equipment. Eight of the eleven manufacturers responded. Three of the eight were not at that time in a position to submit a proposal, the remaining five all sent representatives to the Bureau for a detailed study of the requirements. After this detailed study two of the manufacturers decided that they could not make timely delivery of equipment to meet the Bureau's needs. Three proposals were actually received but one was subsequently withdrawn by the manufacturer leaving only two to be considered by the Bureau. These two were from the Sperry Rand Corp., proposing the use of Univac equipment, and from the IBM Corp. proposing the use of their new type 705 equipment. As requested in the Bureau's statement to the manufacturers each of the two proposals received covered three phases

of the work; (*a*) the initial conversion to an electronic system, (*b*) the annual updating of earnings records and (*c*) the investigation of earnings items reported with incorrect account numbers. The two proposals were carefully studied and costs compared on each of these phases. On the basis of both short range and long range feasibility and economy, a decision was made to obtain the IBM-type 705 system.

2. *Brief description of operations which have been converted to electronic data processing*

The first electronic data processing equipment was installed early in 1956. As indicated above, the initial applications for which this equipment was utilized were the annual updating of the earnings records for all individuals covered by the social security program and the investigation of earnings items reported with incorrect account numbers. Both of these applications proved to be highly successful and as the Bureau's staff gained experience with the equipment they turned to the investigation of other possible areas in which savings could be realized by converting to electronic data processing methods. These investigations together with improvements in both the speed and the capacity of the equipment have resulted in a gradual extension of electronic data processing to other areas. The major operations which have been converted are as follows:

(*a*) Earnings records are now updated quarterly instead of annually. Under the original application, although the updating of earnings records was being performed on magnetic tape equipment, a byproduct of this magnetic tape operation was a master punchcard file which contained a summary of the earnings and which was utilized for claims reference and for operations leading up to the annual updating process. Earnings items which were reported quarterly by employers were punched onto cards, sorted into social security account number sequence and matched on name and account number with the master summary cards; the earnings items which had incorrect names or account numbers were rejected for further investigation. Those which matched were retained in file and converted to magnetic tape prior to the annual updating operation. Under the new system, earnings cards are converted to magnetic tape immediately after being punched. All of the balancing of employer reports, the sorting operations, and the matching to the master records are now performed on electronic equipment quarterly and the matching operation has been combined with the updating operation into a single quarterly process.

(*b*) Seventeen large employers are now reporting about 1,500,000 earnings items quarterly on magnetic tape—eliminating the need for manual punching of these items by the Bureau.

(*c*) The extracting of earnings records for individuals who have filed claims for benefits, or who have requested statements of their earnings, is now performed electronically. As in (*a*) above, under the original application a punchcard file was still used for claims reference purposes. Under the present process a special claims reference tape is produced as a byproduct of the updating operation. This tape is much more closely condensed than the master earnings record in order to facilitate rapid searching for individual accounts. The entire file of claims reference records is searched on a bidaily basis and the information extracted for those individuals for whom claims for benefits

have been received. This information is then used on electronic data processing equipment to compute the primary benefit amounts and to prepare an abstract of the earnings record which then becomes part of the claim file. The combination of quarterly updating plus performing the claims search and computations on magnetic tape instead of on punchcards has enabled the Bureau to eliminate all of its major punchcard files.

(*d*) Establishing new social security accounts and the basic files and records is now largely accomplished by electronic methods. Notable among these is the national alphabetical index of social security accounts which has been converted from a former visible index strip record prepared from punchcards to a combination of magnetic tape and microfilm record with the magnetic tapes being used as a means of producing updated microfilm.

(*e*) A magnetic tape file of employer names and addresses has been established so as to completely mechanize the preparation of correspondence with employers on improperly reported earnings items which cannot be identified in the regular operation.

(*f*) The production of byproduct statistics on earnings, employment, insured status, etc., has been substantially converted to electronic methods.

5. Impact on Bureau personnel

The initial applications of electronic data-processing equipment in 1956 resulted in a decrease in personnel requirements of about 250 to 300 from the number of people which would have been needed if the Bureau had continued to use conventional punchcard methods. Each subsequent extension of the use of the equipment has also resulted in a reduction of personnel requirements. It is estimated today that if the Bureau had not converted to electronic data processing it would need from 700 to 800 more people than it now has.

The Bureau has been fortunate in being able to make these changes without the need for any actual separation of employees. There are two main reasons for this. First, there has been a more or less constant growth in Bureau workloads due to normal expansion of the covered population as well as the periodic amendments to the program. For this reason it has been relatively simple to retrain individuals displaced by the introduction of electronic equipment and assign them to other essential operations in which additional staff was needed.

The second reason is that the individuals who were displaced by the equipment were for the most part relatively low level clerks and machine operators. Turnover rates are fairly high at these lower clerical levels. The introduction of the new equipment and the conversion of different operations, although accomplished with all practicable speed, has spread out over a number of year and there has been sufficient turnover to permit a reduction in staff by attrition in those situations where the staff could not be utilized in other operations.

Although the introduction of electronic equipment has substantially reduced staff needs, primarily at lower clerical levels, it has also provided opportunities for many individuals to qualify for higher level work, both as operators of the new type of equipment and as programers and systems analysts for the equipment. The equipment is operated on a three-shift basis with a total operating staff of about 140 people in grades GS–3 through GS–12. About two-thirds of

this staff were formerly at the GS–2 and GS–3 level. The bulk of the programing staff at grades GS–7 through GS–12 were originally selected from individuals at the GS–5, GS–7, and GS–9 level who have been given progressively more responsible assignments as their experience and technical skills have increased. Thus new opportunities have been opened up for those individuals who can qualify for this higher level of work.

From the time of the first installation of the equipment careful attention was paid to the possible effects of the changeover on Bureau personnel. Every effort was made to keep personnel fully informed, to reassure them that normal turnover and retraining for other positions would make it unnecessary to have any reduction in force, and that the introduction of the new equipment would open up possibilities for further advancement. The Bureau believes that any future expansion of the use of electronic equipment can be accomplished in a similar manner. Although there may be a need for retraining personnel for new operations, it is not anticipated that the extension of the use of the equipment will have any adverse effect on Bureau employees.

Department of the Treasury

Payment and Reconciliation of Treasury Checks

Background

The joint accounting improvement program was instituted by the Secretary of the Treasury, the Comptroller General of the United States, and the Director of the Bureau of the Budget in December 1947. The program is a Government-wide cooperative effort to make Government accounting more efficient and of maximum usefulness. Its purpose is to provide a basis for better management in the executive branch; to give the Congress better information for acting upon appropriations and other legislation; and to give the public a clearer picture of the financial condition and operations of the Federal Government. This cooperative action led to the passage by the Congress of the Budget and Accounting Procedures Act of 1950, which incorporated the basic aspects of the program in permanent legislation and placed, for the first time, specific responsibilities for accounting, auditing, and financial reporting in the Federal Government.

From the inception of the joint accounting improvement program, one of the major fields of work has dealt with simplifying and improving procedures and operations relating to Government disbursements and collections. A major segment in this area concerned the issuance, payment, and reconciliation of approximately 350 million checks drawn annually on the Treasurer of the United States by more than 2,000 Government disbursing officers.

Principles under which the integrated electronic system was developed

While many improvements were made in the disbursements and collections area during the first few years of the joint program, it became apparent at an early date that there were real potentials for savings if the check reconciliation operations, then being performed by the General Accounting Office as a function of external audit, were integrated with the payment operations of the Treasurer of the United

States. This contemplated a reorganization of the payment function of the Office of the Treasurer of the United States in accordance with the following principles:

1. It should be a function of accounting and internal control on the part of the Treasury Department, which is charged with disbursement and custody of the public funds, to effect a proof of checks paid in relation to the checks which are issued.

2. The General Accounting Office, from the standpoint of its responsibilities in connection with accounting systems and independent audit, and the Treasury Department, from the standpoint of its operating responsibilities, should be in complete agreement on the procedures necessary to accomplish such proof of checks paid and the incorporation of these procedures into the accounting system of the Treasury Department as an integral part thereof.

3. In the light of a revised system of accounting and internal control by the Treasury Department, it should be possible to eliminate the detailed reconciliation of checking accounts of disbursing officers as a function of independent audit, substituting therefor reliance upon the effectiveness of internal control as reviewed in actual operation and the furnishing of such data as may be required for comprehensive audit purposes.

Two plans were developed for integrating the check payment and reconciliation functions. One plan was based on the use of check-issue cards (punchcards representing individual checks issued) to be produced by the disbursing officers and furnished the Treasury for matching with paid checks as an integral part of the paying operation. The second plan involved the use of block controls, each block representing 1,000 consecutive checks, with block totals to be reported to the Treasury by disbursing officers and used in relation to like blocks of checks paid.

In order to develop the full potential of each plan, two experiments were initiated. One was conducted in the Federal Reserve Bank of St. Louis during 1950, utilizing check-issue cards for the Army allowance and allotment checks. The second experiment, conducted in Washington, D.C., utilized block controls for checks issued by the Treasury disbursing officer for civil service retirement payments. Valuable experience was gained through these experiments and it was the consensus that the results justified further consideration of the desirability of integrating the check payment and reconciliation function. (It is noteworthy that during this period of experimentation many individual procedural areas were explored with resulting improvements to the existing systems.)

A major consideration in reorganization of procedures was the question of what type of mechanical equipment would provide the most efficient and economical system. Before making any recommendations, it was decided to explore the possibility of utilizing electronic equipment to perform these functions.

Project

In June 1953, the Secretary of the Treasury, the Comptroller General of the United States, and the Director of the Bureau of the Budget appointed a joint committee to conduct a comprehensive study of the possible use of electronic data processing equipment for the payment and reconciliation of Government checks.

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The joint committee's assignment and work program were developed as follows:

Scope

1. Determine whether the use of electronic data processing equipment for an integrated payment and reconciliation function, including related check claim processes, was practicable;
2. Develop the proposed system, in detail;
3. Recommend the manufacturer whose equipment it considered best suited for the system; and
4. Present for consideration the proposed course of action, including a timetable and financial considerations.

Work program

1. Develop in detail the requirements for the clearance, payment, and reconciliation of Government checks drawn on the Treasurer of the United States;
2. Present to manufacturers of electronic equipment specifications for an integrated plan of operations, inviting manufacturers to submit proposals contemplating the use of available equipment or equipment under development;
3. Evaluate the various proposals submitted by manufacturers;
4. Develop a plan for implementing the committee's recommendations, including a detailed operating procedure, budgetary considerations, and a timetable for conversion; and
5. Determine the effect of the proposed changes in the organizational structure, financing, and operation of the disbursing agencies, the Audit Division of the General Accounting Office, the Check Payment Division of the Office of the Treasurer of the United States, and the Federal Reserve banks and branches.

The committee's general approach in carrying out its work program was:

1. *Development of requirements for the clearance, payment, and reconciliation of Treasury checks under existing procedure.*—A detailed analysis was made of existing procedures then in effect for the issuance, clearance, payment, and reconciliation of Treasury checks as well as the procedures for handling check claims as a basis for developing specifications for performing these functions.

2. *Development of a plan for utilizing electronic equipment to perform the payment and reconciliation of Treasury checks.*—Based on analysis of existing procedures and the experience gained during the period of experimentation referred to above, a proposed plan was developed for utlizing electronic equipment to integrate the payment and reconciliation functions on a centralized basis. The plan was developed in some detail including step-by-step procedure, all of which was outlined in chart form. At this time, a review was made of the existing cost for paying and reconciling checks, and sufficient cost analysis was made of the proposed plan to conclude generally that electronic equipment had very definite promise and should be fully explored.

3. *Presentation of the plan to manufacturers of electronic equipment.*—In the fall of 1953, the Fiscal Assistant Secretary of the Treasury addressed a letter to 15 manufacturers of electronic equipment, acquainting them with the project and inviting them to submit firm proposals by December 31, 1953, for an integrated system of check payment and reconciliation utilizing equipment available or under development at

that time. They were requested to give consideration to the program from the standpoint of either centralized or decentralized operations.

In September 1953, a 2-day symposium was held and attended by representatives of interested manufacturers. During this meeting a detailed discussion was had with respect to the entire program. Following the symposium, the committee held individual meetings with those manufacturers' representatives requesting further discussions.

4. *Working relationship with manufacturers.*—The committee worked very closely with various manufacturers for over a year. During the course of this cooperative work, many techniques were developed for improving the various proposals. This information was made available to each manufacturer. Based on discussions and meetings with the various manufacturers' representatives, it was decided to extend the time for submission of proposals to January 25, 1954, with the understanding that manufacturers might present amendments to their proposals at a later date if the committee had not completed its study and evaluation of the various proposals submitted.

5. *Working relationship with Federal Reserve System.*—Early in the spring of 1954, the committee met with representatives of the Federal Reserve System to acquaint them with the study and to review in general terms the principles of the new plan. Discussion was held on the procedural changes and cost factors which would affect Federal Reserve banks.

One of the principal factors which was developed for consideration and further analysis was the proposition of issuing a card check prepunched by the manufacturer with the issuing officer's account number and check serial number to be used in lieu of 25 million paper checks then being issued annually. Under such a procedure, the issuing officer would not punch the amount into these particular checks, but would continue to prepare them as if they were paper checks and the amounts would be punched by the Federal Reserve banks as a part of their normal clearance and collection process. The development of this proposition enabled the committee to consider the practicability of electronic equipment for all checks drawn on the Treasurer of the United States.

6. *Establishment of criteria.*—The committee, with technical advice from representatives of the National Bureau of Standards and the National Security Agency, established the following principal criteria to assist them in determining the manufacturer whose equipment it considered would be best suited for an integrated system for payment and reconciliation of Government checks:

(1) Reliability and efficiency of equipment.
(2) Cost—purchase versus rental.
(3) Direct labor requirements.
(4) Cost of supplies (tape, etc.).
(5) Maintenance and service requirements.
(6) Specifications and cost for installation (space, electricity, air conditioning, etc.).

7. *Evaluation of manufacturers' proposals.*—Proposals were received from five manufacturers and a detailed analysis was made of each. During the course of analyzing these proposals, numerous meetings were held with the manufacturers' representatives. As a result of this work, three proposals were amended to take advantage of significant

savings in time, controls, and processing techniques. These three proposals were practically identical so far as principles of procedure were concerned.

It is significant that all manufacturers finally proposed a centralized operation. It was determined that decentralization of any of the functions under the proposed plan would be prohibitive from a cost standpoint.

One of the three acceptable proposals had to be disregarded inasmuch as the equipment would not be available for at least 1 year subsequent to the availability of the equipment of the other two manufacturers.

Tests were conducted on the equipment proposed by the two remaining manufacturers, utilizing paid checks in the file of the General Accounting Office. These tests were conclusive that procedures could be designed to perform an efficient and economical integrated payment and reconciliation function, utilizing electronic techniques. Evaluation of each manufacturer's proposal and equipment resulted in entering into a rental contract with the International Business Machines Corp. for a complete electronic data-processing system.

8. *Estimated savings.*—In order to arrive at a sound basis for estimated costs, a step-by-step procedure under the new plan was developed. Each step was tested on electronic equipment and was timed to determine how much equipment and personnel would be required to operate the new system.

The committee made eight recommendations, all of which were closely related. The following, which is quoted from the committee's final report, summarizes the conclusions:

Recommendation No. 1.—The check payment function of the Treasurer of the United States should be reorganized under an electronic data processing system to provide (*a*) proof of checks paid by comparison with checks issued, and (*b*) development of the necessary data, including outstanding checks, for the reconciliation of disbursing officers' checking accounts.

Comment.—Procedures have been designed and tested to account for check payments in direct relation to amounts of checks issued, as a feature of internal control. These procedures provide for (1) earlier disclosure of certain discrepancies for which either disbursing officers or the Treasurer of the United States are accountable, and (2) development of outstanding check data, both being an integral part of the function of paying and accounting for Government checks. This makes it possible to eliminate the present separate reconciliation operation in the General Accounting Office, without impairing the effectiveness of the audit and settlement of Government disbursing officers' accounts.

It might be helpful to briefly discuss (1) the preparatory action taken during the fiscal year 1956 and (2) the program for the fiscal years 1957 and 1958.

Preparatory action taken during fiscal year 1956

From savings and reduced spending effected during the fiscal year 1956, it was possible to accomplish the following, preparatory to the installation of the new operation:

1. Relocated all operations previously located on the first floor of the Liberty Loan Annex at Washington, D.C. This involved the dismantling and reassembling of steel file shelving occupying approximately 3,000 square feet of floor space, and the moving of the large photostat installation used in connection with check-claims operations. There was also brought together on the first and second floors

of this building the entire check-payment operation. The snack bar was moved from the first to the fifth floor.

2. Contracted for and accomplished the complete renovation of that area of the first floor of the Liberty Loan Annex selected for housing the electronic data-processing equipment.

3. Installed the machines needed to process the first phase of the operation.

4. Procured the equipment necessary to move and process the checks converted under the first phase of the operation and installed a large quantity of metal shelving for their temporary housing.

5. Procured a sufficient stock of magnetic tape to supply operational needs through the first quarter of fiscal year 1957.

6. Worked out arrangements with General Services Administration whereby they would completely service the checks after they had been processed, i.e., they would pick the checks up at the Liberty Loan Building, file them in protected storage, search and deliver all filed checks required in connection with claims and inquiry cases.

7. Conducted some preliminary studies with a view to determining the necessary reporting requirements which will afford the information essential to establishment and maintenance of an adequate cost-ascertainment system.

8. Selected and trained personnel for the programing and operation of the electronic data-processing equipment.

9. Conducted an intensive employee-placement program to assist employees whose services would no longer be needed under the new program. This included the voluntary training of typists after office hours.

10. Accomplished the conversion of the majority of the accounts from the use of paper to card checks.

11. Rewrote regulations or prepared new ones where necessary and promulgated them to all Federal Reserve banks and disbursing officers.

Program for fiscal years 1957 and 1958

Action necessary to effect the installation of the new program in its entirety involved a month-to-month change in operations as well as personnel and other requirements. First, it was necessary to process the work backlog carried over from fiscal year 1956 as a result of the personnel policy followed whereby approximately 90 of the employees to be released were placed at the time positions were available elsewhere rather than upon completion of the work. Those employees retained during 1957 to process the backlog, who did not resign or retire, were assisted in every way possible to obtain reassignment by transfer to other divisions, bureaus, or agencies.

Acquisition and training of employees for the new function, other than programers and operators of electronic equipment, was a continuing action over the greater part of the 1957 fiscal year.

As the operations changed during the fiscal years 1956–58 so also did the type of personnel required to perform those operations change. In lieu of check examiners, sorters, reviewers, stating clerks, and adding machine operators, necessary under previous procedure, employment needs gradually changed to reconciliation clerks and electronic data-processing machine operators calling for higher caliber people with greater skills, hence higher grades.

Selection and training of electronic data-processing personnel

During November 1955, arrangements were made to initiate a training course looking toward the eventual programing and operation of the electronic data-processing equipment required for the new system. In considering this matter, the Secretary of the Treasury and the Comptroller General were keenly aware of the desirability of giving every consideration possible to the personnel who would eventually be affected.

Employees in the Office of the Treasurer of the United States and the General Accounting Office were given an opportunity to qualify for this training via an aptitude test. First consideration was given to the affected employees, i.e., employees of the Check Payment Division, Office of the Treasurer of the United States, and Check Reconciliation Branch of the General Accounting Office. Inasmuch as we were unable to obtain a sufficient number of employees (40) to send to programing school from these two organizational units, it was necessary to expand our efforts to other divisions of both offices. Hence all other employees in the Office of the Treasurer of the United States and the Division of Audits of the General Accounting Office were given an opportunity to qualify for this training.

In addition to the aptitude test, a supervisor's written evaluation was obtained for each employee who made an acceptable rating on the aptitude test. Initial groups of employees to receive training in electronic programing were selected in early 1956, as follows:

(*a*) Eighty-two employees of the Check Payment Division, Office of the Treasurer, United States, took the aptitude test; eight were selected for training.

(*b*) One hundred and thirty employees of the Depository Accounts Branch, Division of Audits, General Accounting Office, took the aptitude test; 16 were selected for training.

(*c*) Ninety-five additional employees of the Treasurer's Office (divisions other than Check Payment) took the aptitude test; seven were selected for training.

(*d*) Thirty-seven employees of the Division of Audits, General Accounting Office (branches other than Depository Accounts) took the aptitude test; 10 were selected for training.

It should be noted that employees under (*a*) and (*b*) were directly affected by the contemplated conversion program and were given the first opportunity to qualify.

Arrangements for the training were made with the manufacturer of the data processing equipment to give a 4- to 6-week intensive course in the fundamentals of programing. Two identical courses were given to the employees selected above: 20 employees attended the first course and 21 the second. Of the 41 employees sent to school, 18 made acceptable marks.

Late in 1956, as the need for additional employees in the electronic data processing operations developed, circulars were again distributed to all employees of the Office of the Treasurer to obtain an additional list of employees interested in transferring to electronic operations; 78 employees indicated interest and took the aptitude test. On the basis of marks achieved in the test, 16 were selected to attend 4 weeks of formal training. Upon completion of this training 7 of these were reassigned to electronic operations.

In the middle of 1958 another call went out to employees of the Office of the Treasurer to determine those still interested in receiving training in electronic operations; 60 responded to the call; 48 were given an aptitude test; 12 were considered on the basis of scores made in previous tests; 20 were selected for training; 6 made acceptable grades and will be detailed in the near future to attend additional courses in programing.

The following table summarizes in terms of numbers of personnel the results of our approach in this matter:

	Tested for aptitude	Selected for training	Successfully completed instruction and assigned to electronic operations
Treasurer, U.S.	303	51	15
General Accounting Office	167	26	8

Although supervisory evaluations were used, the aptitude test was the principal guide for selecting candidates to attend the formal classes of instruction in programing. Final selections of employees to become regular programers or operators of this equipment were made on the additional basis of marks achieved in programing school and satisfactory performance of programing duties on subsequent detail assignments.

Generally speaking, the use of the aptitude test as the main guide for selecting employees to receive training in electronic programing has been satisfactory. Our experience establishes the fact, however, that final selection of the employee for regular electronic operations should not be made until the employee has demonstrated acceptable completion of programing classes and progress while detailed to actual programing work. Also, it is interesting to note that, based on our experience, a person who passes the aptitude test with an acceptable rating and has a good background in conventional tabulating operations appears to comprehend a little more quickly the problems inherent in developing computer programs. Another interesting fact is that a number of employees, considered by their former supervisors as doing only a satisfactory job, have turned out to be among the best programers we have developed.

In short, the experience of the Treasurer's Office in this matter leads to the conclusion that employees with an aptitude for programing as indicated by acceptable scores achieved in the aptitude test, and who make acceptable marks in formal classes in programing and who show sufficient interest and effort on their part, have an excellent chance of becoming good electronic personnel.

Probably the most difficult task we experienced was in translating or defining the requirements of the integrated check payment and reconciliation process to the personnel selected to program the job. It pointed up the necessity for systems people to describe proposed processes in much greater detail than had ever been required previously for conventional type of equipment.

Equipment was delivered to the Treasurer's Office in early 1956. The changeover required about 17 months (5 months more than originally estimated).

Final estimated savings

Based on a comparison of fiscal year 1959 costs with the last year of operation completely under the old system, the new plan is estimated to save almost $3 million annually. As a result of the conversion, a total work force of some 1,597 employees in the Treasury, General Accounting Office, and Federal Reserve System has been reduced by approximately 50 percent. Final estimated savings exceeded original estimates by about $750,000.

Issuance and Retirement of U.S. Savings Bonds

Background

In 1948–49, at the request of the Commissioner of the Public Debt, representatives of the National Bureau of Standards studied the series E savings bond operations performed by the Bureau of the Public Debt, and filed a written report with the Commissioner advising that the use of electronic data processing machines of the so-called "giant brain" type in the conduct of such operations was feasible and would lead to substantial economies in operating costs. The Bureau of Standards offered to build the necessary machines. The Bureau of the Public Debt was unable to obtain funds therefor and the project was abandoned temporarily.

Thereafter the manufacturing of electronic data-processing machines by commercial companies and their use by industry advanced rather rapidly. In 1955 the Commissioner of the Public Debt decided that, in view of the progress being made in the field, his organization should initiate another feasibility study, having as its objective the determination of whether data-processing machines of the kind then being manufactured could be effectively and economically used on series E bond operations. The study was conducted by a four-man committee, appointed from among especially qualified employees of the Bureau of the Public Debt.

Scope

The aforementioned study made by representatives of the National Bureau of Standards in 1948–49 concluded that operations relating to auditing the issue and retirement of E bonds, the preparation of required accounting reports, and recordation of the fact of issuance and retirement of such bonds by name of owner, bond serial number, issue date, etc., were feasible of effective and economical conduct on electronic data-processing machines. The committee appointed by the Commissioner of the Public Debt was instructed to restrict the scope of its study to a determination that such things were possible of successful accomplishment on commercially available equipment.

In July of 1955, representatives of 11 of 14 invited companies attended a symposium conducted by the Commissioner's committee at which the then current series E savings bond operations were explained to them in detail. Representatives of 9 of the 11 companies visited the Chicago office of the Bureau of the Public Debt in October of 1955 for the purpose of getting a firsthand view of most of the savings bond

operations then under discussion for conversion to electronic data processing.

After having the operations explained to them in detail and seeing the work being performed, four companies submitted tentative proposals to the Commissioner of the Public Debt late in the calendar year 1956, stating that they had equipment which they believed could do the savings bonds job electronically and that they, therefore, would continue working on the project and submit firm proposals for accomplishing the job. One of the four companies subsequently dropped out of the picture. The remaining three submitted their firm proposals in February of 1957. After they had been studied and evaluated by the Commissioner's committee, the proposal submitted by the DATAmatic Corp., Newton Highlands, Mass., was accepted by the Commissioner on March 22, 1957, as the most advantageous to the Government.

The first components of the DATAmatic 1000 System were installed in Public Debt's new Parkersburg office in April of 1958, just about a year after the award of contract. Card-to-tape conversion operations only were conducted by the office until November 1958, when the central processor unit of the system was installed. After a short period of debugging, the overall system was found to work effectively.

Summary of prior procedure

Under prior procedures, the work had been mechanized to the fullest extent possible. Electrical accounting, microfilming, and bookkeeping machines were used extensively. At the same time many manual operations were performed, particularly in connection with the development of alphabetical files reflecting the ownership of series E savings bonds and recordation by bond serial numbers of the payment of such bonds.

Under the prior procedures, in order to establish the alphabetical file of ownership, registration stubs were key punched with owners' names, sorted alphabetically on IBM machines, fine sorted by hand, and then microfilmed. Issues for 6 months were included in a single microfilm record. A numerical registration record was also developed annually by sorting on IBM machines prepunched bond serial numbers in the registration stubs; after sorting the record was microfilmed.

In order to audit and record the retirement of paid bonds, a tabulating card was key punched and key verified for each bond. The card was punched to show bond serial number, amount paid and issue date. The card was then processed on various pieces of IBM equipment to (1) verify the amount paid against the true redemption value of the bond, and (2) prepare listings of the bonds by series, denomination and serial number. The listings were sent to the Chicago office of the Bureau of the Public Debt where each bond contained therein was posted manually in registers of retired bonds. Each posting was verified manually.

Searching of both the issue and retirement microfilm records was strictly a manual operation.

Summary of present procedure

Under the new procedure, both registration stubs and retired bonds are key punched with prescribed data essential to the location of such document in the microfilm records. After such data have been key punched and verified, the documents are run through electronic machines, which results in recording the data on magnetic tapes. This information recorded on magnetic tapes is used to audit and account for issues and retirements and for the preparation of accounting reports used in the maintenance of central public debt accounts in Public Debt's Washington office. The tapes also contain the master records of bond ownership and of bonds retired on any account. These records are sorted and merged with previous records resulting in the establishment and maintenance of an updated file of bond ownership and status.

The use of the electronic system resulted in the elimination of the following principal manual operations:

1. Alphabetical fine sorting of registration stubs.
2. Posting of retired bonds to retirement ledgers and the verification of such postings.
3. The recordation of caveat entries in the retirement ledgers.

After registration stubs and bonds have been recorded on tapes, mechanical means are utilized to obtain reference information to readily locate images of such documents in the microfilm record. Caveats are recorded mechanically.

Estimated savings

It is estimated that installation of the electronic data-processing system in the Bureau of the Public Debt is directly responsible for a net reduction in force of approximately 350 employees, largely in grades GS–2, 3, and 4.

Installation of the electronic system is expected to result in annual savings of between $750,000 and $1 million.

Civil Aeronautics Board

1. The statistical processing problem presented by the origin and destination surveys

The Board's domestic and international origin and destination surveys of U.S. air carrier passenger traffic show number of trips by city pairs of origin and destination with a classification under each city pair by trip routing (airlines used and cities of transfer between airlines) and a further separation in the domestic survey by class of travel (first-class or coach). The possible combinations of city pairs between which air trips can be made is very great and there is typically a wide choice of routings—with often more than one class of service—by which to travel between any two cities. These facts coupled with the large and rapidly growing volume of air passenger traffic make the origin and destination surveys by far the largest single statistical project in the Board.

Twenty-six air carriers participate in the domestic survey. The basic detail as reported by these carriers for an average quarter amounts to about 150,000 different trip routings which require about 3 million card passes to complete the survey. Essentially, the Board's processing of these reported data is a matter of combining like trips and arranging the resulting statistics in an orderly manner for publication and convenient use.

Some 36 U.S. air carriers participate in the international survey (although a much larger number of air carriers appear in routing detail because of the inclusion of foreign-flag carriers wherever they provide part of the transportation in the trip). The detail as reported for 1 month (the international survey covers March and September only) amounts to about 85,000 different routings which require about 1,600,000 card passes.

In connection with the domestic survey, a series of special tabulations entitled "Competition Among Domestic Air Carriers" is produced regularly in addition to the main origin and destination statistics, but in the same process. This competitive study represents a conversion of the origin and destination data, reflecting the complete one-way trip as a unit, to on-system trips with initial and terminal points on a single carrier as the unit. Efficient production of the competitive study requires that it be accomplished at certain stages in the processing of the main survey.

2. Survey processing methods before EDP

The Board has been making origin and destination surveys for 20 years. Prior to 1948 all operations were manual. Manual processing was possible then because of the relative simplicity of airline routes and services and the much smaller traffic volumes. Nonetheless, about 12 persons were required for this work in 1947, and even with this staff the surveys had grown to a point where they could not be completed on a reasonably current basis.

First machine processing of the Board's surveys was performed by the Bureau of the Census with IBM punchcard equipment under a service arrangement (1948–50). However, it was found that the Board could have its own IBM installation at less cost than under the service arrangement and in addition to the surveys there would be the possibility of doing other work on the machines. Consequently, the Board established an IBM unit in 1950 for the primary purpose of processing the origin and destination surveys.

3. Need for more efficient processing methods

With the steady sharp growth and expansion of the air transport industry, the burden of collecting and processing the origin and destination surveys continued to increase. Beginning with September 1952, it was necessary to reduce the period for the domestic survey (which was then on a March-and-September basis) from 2 full months of the year to two periods of 2 weeks each. Some time latter, also, the possibility of producing the surveys on an electronic computer at the Bureau of the Census was explored but the idea was dropped when

it was found that availability of machine time on a regular basis could not be assured.

Effective January 1, 1959, the Board's domestic survey was changed from the March-and-September periodic basis to a continuous 10-percent sample basis with quarterly reporting by the carriers. This was done primarily to improve the usefulness and reliability of the data but with the knowledge also that it would distribute the airline collection work more evenly over the year and avoid the peak workloads created twice a year by the previous system. To realize the full advantages of the new domestic survey method, processing and publication on a quarterly basis to provide measures of traffic seasonality would be necessary. In addition, an annual summary for the calendar year would be essential for many uses. Thus, the Board was faced with the need for producing five surveys a year, with a minimum of delay, at a time when it was no longer possible with the punchcard equipment to keep the surveys current on a twice-a-year basis.

Moreover, there are much-needed improvements in the content of the survey (such as, the showing of all cities in trip routings, not merely interline transfer cities) which it was hoped to work out eventually but which would not be possible under the capacity limitations of the punchcard equipment.

These considerations led to further exploration of electronic data processing equipment and services.

4. Electronic data processing on Bureau of Standards IBM 704 computer

Upon investigation, it was found that the Bureau of Standards had time available on its IBM 704 computer and that it could undertake the Board's survey processing on a regularly scheduled basis. Estimates developed by Bureau staff indicated that, after conversion to electronic processing, there would be remarkable savings in both cost and time over what would be possible with the Board's punchcard installation. Programing the origin and destination survey for processing on the IBM 704 was estimated to cost $20,000 and require about 1 year to complete. The recurrent processing costs were estimated at $4,000 per quarter, or $20,000 per year including the annual summary. This compared with an approximate cost of $18,000 for each semiannual survey processed on the Board's conventional punchcard equipment—or an estimated $90,000 per year for four quarterly and one annual tabulation. In terms of calendar time, it was estimated that each survey could be completed by electronic processing in less than 3 months from the end of the period covered as compared with 9 months or more required on the punchcard equipment. On the basis of these estimates, it was decided to convert the domestic survey to the IBM 704, funds for programing were requested in budget estimates prepared in mid-1958, and programing started in July 1959.

Actual programing cost (amount spent to date plus estimated additional still required) will be about $20,000, substantially the same as the original estimate. The total time required to do the programing

will be about 1 year as originally estimated. As a matter of fact, the experience with the programing has been somewhat better than originally anticipated since both the origin and destination survey and the competitive study are being programed whereas the latter job had not been included in the original estimate.

Processing of the first survey on the IBM 704 got well underway during the first half of 1960 and it was originally scheduled for completion by May 15. However, processing difficulties that had not been anticipated required that the completion date be extended into July—and even this date is tentative. Moreover, the experience in actual processing of the survey on the IBM 704 soon demonstrated that the recurrent production costs would run much higher than the original estimates. It was found that, although the IBM 704 was admirably adapted to computing work, it was much slower in "sorting" operations than had been expected. Since "sorting" is a major part of the origin and destination survey processing this has substantially increased the machine time required. Also, it had been expected that production of the competitive study along with the main survey would add little to the total cost but experience has failed to support this belief. Estimates now indicate that the annual processing costs for four quarterly and one annual summary of the survey and competitive study would be about $42,000 rather than the very favorable $20,000 originally estimated. The Bureau of Standards estimates that processing costs will be materially reduced in about 2 years when equipment of more recent vintage than the IBM 704, and which is better adapted to the production of a job like the Board's survey, is available to the Bureau of Standards.

The revised cost estimates substantially exceed the amount budgeted for the work. As a result it has been necessary to reduce, for the time being at least, the number of issues per year from the desired five to two semiannual tabulations. This will significantly reduce the value of the statistics.

Final conclusions relative to the advantages and disadvantages of processing the Board's origin and destination surveys under the service arrangement with the Bureau of Standards will have to await completion of the first survey and attainment of a normal stage in the processing. However—and despite the higher-than-anticipated processing costs—it seems clear that the Bureau of Standards processing of the origin and destination survey will have definite cost and time advantages over the Board's existing low-speed punchcard equipment. It is not so clear, however, that these advantages will continue to exist in comparison with a Board installation of the relatively low cost but nonetheless high-speed tabulating equipment now on the market or soon to be available as mentioned in the following section.

Whatever the ultimate conclusions may be as to the relative advantages in the Board's particular case of the Bureau of Standards' service, such a service makes available to any agency whose needs for

tabulating or computing services would not be great enough to justify its own installation the potential economy, speed, and capacity inherent in a modern electronic data-processing facility.

5. Reevaluation of the Board's overall mechanization program

Production of the origin and destination surveys represents only a part of the statistical processing work of the Board. Although the traffic surveys are by far the largest data processing jobs now produced by the Board, the other jobs combined represent a task of considerable magnitude and importance. Exploration and exerimentation in methods for doing more of the Board's statistical work with modern machines has been underway for some time. The substantial and unexpected increase in the processing costs on the Bureau of Standards' IBM 704 will require a more intensive and broader reevaluation of the available machines and methods from the point of view of the overall statistical processing needs of the Board.

The feasibility of a Board installation of electronic data-processing equipment capable of doing both its origin and destination surveys and its other statistical work has been explored in the past. It was found, however, that with the electronic machines heretofore available the overall cost of such an installation would substantially exceed the estimated $20,000 annual cost of utilizing the Bureau of Standards service plus the cost of the Board's existing punchcard facility.

By 1958 relatively low-priced electronic computers of small capacity had become available. As an interim step in exploring the feasibility of electronic data processing in the Board's general statistical operations a computer of this type (Royal-McBee LGP–30) was rented and is still in use. This computer has been initially employed in the audit of air carrier reports. Statistical publications which can be processed as an integral part of this report audit function are being converted to the LGP–30 to the extent machine capacity and programing facilities permit. However, such a machine could not serve the Board's overall needs, particularly because it is not capable of handling origin and destination survey work.

In the process of considering whether or not to contract the origin and destination survey work out of the Bureau of Standards careful study was given to the possibilities of RAMAC as a means by which the Board could have its own facility to produce the surveys and also do other statistical work of the Board. Considerations of relative capabilities of the machines as well as anticipated costs led to the decision to use the IBM 704.

Continuing study is being given to the most efficient means of doing the Board's statistical work. New electronic data processing equipment which reportedly will be available in the near future may well reduce the annual cost of an installation (with staff) adequate to service the over-all needs of the Board to approximately $160,000. While this would be somewhat more than the total amount now budgeted by the Board for the IBM 704 services and the IBM punchcard and LGP–30 programs it is based upon the projection of a substantially greater capacity than the presently being used. Further consideration will be given to the possible advantages of such an

installation as compared with the continued or expanded use of outside services whether at the Bureau of Standards or elsewhere.

Veterans' Administration

The VA's paperwork—or data processing—is of monumental proportions. The size of VA's responsibilities and variety of its programs can be demonstrated by the following:

More than one-half million patients were admitted to VA hospitals last year and the average daily patient population was over 110,000.

More than $3 billion in benefits were paid to veterans and their dependents at the rate of $250 million per month.

The VA's life insurance program involves approximately 6.4 million insurance policies in force with a face value of $43 billion.

These and other large-scale data-processing operations convinced VA that the use of electronic computer systems in its daily work offered many advantages and benefits. The following is a summary of VA's planned and present use of electronic computer systems and a more detailed description of its life insurance application.

In the VA Data Processing Center, Hines, Ill., a large-scale computer system, using IBM 705 equipment, has started processing the monthly issuance of 4,700,000 benefit checks to veterans and their beneficiaries. The system designed for computer processing has several interesting features. Service to veterans will continue to be provided at convenient decentralized locations, for VA regional offices (67) will continue to adjudicate claims and maintain the veterans' basic records. Pay and statistical records will be maintained on magnetic tape at the VA Data Processing Center. Changes and additions to this magnetic tape—or master record file—will be produced by the regional offices on paper tape and forwarded to the center. Through the use of a special kind of typewriter the paper tape will be produced as a byproduct of the regional offices' normal operations and used by the center to automatically convert the data to computer language.

The computer system will provide the monthly check payment data in machine processable form to the Treasury Department for the automatic production of checks and for the presorting of checks by destination code. The latter will eliminate sorting of millions of Government checks in the Post Office Department, and will speed delivery of checks to the VA payees.

A relatively small electronic computer has been installed in the VA's central office, Washington, D.C. It is used as a complement to the punched-card machine installation which operates on a service bureau basis for all departments and staff elements of the VA. It performs a wide variety of data-processing operations ranging from nationwide report consolidation to laboratory testing and experimentation in data-processing techniques.

For the future, an automatic data-processing system that will integrate the common service areas of fiscal, supply, payroll, and personnel statistics into a total agencywide system is being designed.

Of great importance, not only to the VA but to all of mankind, are studies on the development of techniques that would automatically yield patient data information, from the half-million veterans the VA treats in its hospitals each year, for medical research and clinical evaluation.

By most standards, the VA's life insurance program is one of the world's largest. There are approximately 6.4 million policies in force. The annual income from premiums, etc., is $891 million. Annual disbursements amount to more than $786 million. Invested funds amount to $7 billion. There are more than a million accounts with dividends on deposit, 401,000 policy loans, etc.

The VA's Department of Insurance conducts this mammoth record-keeping and accounting operation at three field stations, VA district office, Philadelphia, Pa., and the VA centers at Denver, Colo., and St. Paul, Minn. In July 1959 the Department launched the VA's first large-scale electronic computer system, using IBM 705 equipment, in the Philadelphia district office to process the premium billing and accounting operations of the VA life insurance program. The following are the main features of the system.

The heart of the system is the master record file. This file, on magnetic tape, will contain such information as policy number, name, age, date of issue, kind of insurance, address, premium rates, and other related data about each individual's policy. Premium payments, loan payments, or any other type changes will also be converted to magnetic tape (transaction tape). These two tapes will be processed through the computer each day to produce a new up-to-date master record tape and at the same time perform the following functions:

Premium posting.
Premium billing.
Loan accounting.
Loan interest billing.
Lien accounting.
Lien interest billing.
Dividend credit and deposit accounting.
Dividend payment.
Lapse processing.
Renewal of term insurance.
Allotment and deduction accounting.
Miscellaneous file maintenance.

Other functions will be performed on a monthly, semiannual, or annual basis. Some of these are:

Statistical summarization of record data.
Reconciliation of the allotment and deduction control file.
Updating of dividend rates in the master file.

The day-to-day operations are still handled by the three insurance field stations. Every day the VA receives more than 100,000 premium payments, besides a great mass of other subject matter which amounts to about 23,000 items. This includes applications for loan, reinstatement, premium waiver, policy change, etc. The field station procedures are as follows:

Payments are verified against premium notices (punched cards) to ensure premiums are paid as billed. The premium notices are

listed mechanically and batched with summary cards indicating batch totals. Payment checks are proof listed and classified for deposit through the use of bankproof machines. The bankproof machine batch totals are compared with the premium notices batch totals, any differences are reconciled, and the money deposited. The premium notice cards are forwarded to the computer center in Philadelphia. The items of miscellaneous subject matter such as applications, request for policy changes, inquiries, etc., require information from the computer center. Punched card requests for status of accounts are prepared and forwarded to the computer center and the source documents retained pending receipt of requested information. Upon receipt of the data (record printouts) from the computer center the applications, inquiries, etc., are processed. Any action which may result in a change to the master record is reported to the computer center in punched card form.

A transceiver communication system will connect the western insurance offices with the computer center in the Philadelphia district office.

The computer center mechanically verifies the punched cards received from field stations by use of control—or batch—totals and converts the cards to magnetic tape. Using these tapes the electronic computer system processes the data in the following pattern:

The computer's first run is to create the day's transaction tape by merging the field station tapes into a single tape in file number order. At the same time it edits for priority of sequence as to the actions to be taken.

The main daily processing run updates the master record, produces a new master record tape for the next day's operation and five additional output tapes to perform the following:

Disbursement tape: This tape is converted to punched cards showing disbursement data on various types of refunds or withdrawals. These cards are forwarded to the Treasury Department for payment.

Premium notices tape: Produces the punched-card premium notices for mailing to the policyholders.

Consolidated output tape:[1] Processed through high-speed printers to produce such items as lapse notices, renewal notices, requested receipts, etc., for mailing to policyholders.

Record print-out tape:[1] Processed through high-speed printers to provide the status of account information requested by the field stations.

Transaction tape:[1] Prepares the printed listing of the daily transactions. The selistings are used as reference for handling inquiries, claims, underwriting actions, etc.

To provide a fast, accurate, and economical system for retrieving case history material a unique system was developed. Each daily transaction is identified with a single printed line of up to 120 characters. The 150,000 daily transactions are printed on about 3,000 sheets. These sheets are divided into 500 segments and each segment

[1] These output tapes require additional computer processing runs to separate the subject matter by different type of action or by station.

is housed in a lateral magazine-type file by the number of the day in the calendar year. For example, January 1 is the first day of the year, April 15, 1960, the 106th day, etc. All an operator will require to locate an item would be the file and policy number of the account and the number of the last day it was processed. A specially designed Thermo-Fax Selective Copier, worked with each file, automatically reproduces a line, or lines, of data, in an average of 30 seconds.

The conversion of World War II and Korean insurance accounts began in August 1959 and will be completed in 1961. It is expected that World War I insurance accounts will be converted shortly thereafter.

This is the Veterans' Administration EDP story to date. It is believed the VA will benefit from automatic data processing. It will facilitate some of the massive recordkeeping, calculating, and accounting which is required in the daily work. It will eliminate dull routine tasks; reduce the number of record and data files; allow better use of human resources; and provide better services at lower operating costs.

INVENTORY OF ELECTRONIC COMPUTERS IN THE FEDERAL GOVERNMENT

As of June 30, 1960, the Government had at its disposal 524 electronic computers, exclusive of those for tactical and classified uses in the Department of Defense. For the purposes of this inventory, a computer is defined as equipment which uses electronic circuitry, internally stored instructions, and memory storage as the means of processing digital data. The following table gives the distribution of these computers among the various departments and agencies, classifying them according to size and showing which are Government-owned and which are rented from equipment firms. Privately owned computers used to perform work for Government agencies either on a service-bureau basis or under contract are not included.

The Department of Defense controls 364 computers, approximately 70 percent of the total. The Atomic Energy Commission uses 52 computers, accounting for 10 percent. Another 12 percent is found in the combined holdings of the Department of Commerce, the National Aeronautics and Space Administration, the Federal Aviation Agency, and the Post Office Department. The remaining computers are widely distributed among other Federal departments and agencies.

The classification of computers into three size groups, i.e., small, medium, and large, necessarily involved some arbitrary determinations. However, as a general rule, computers which would rent for less than $10,000 a month are in the small category, those which would rent for $10,000 to $25,000 a month are in the medium category, and those which would command monthly rentals in excess of $25,000 are classified as large. On this basis, small computers account for about 55 percent of all computers directly utilized by the Government. The balance is about equally divided between medium and large computers.

Approximately 85 percent of the total of 524 computers used by Federal agencies is rented from equipment manufacturers. Only 85 have been purchased, including 17 constructed especially for the Government. In these 17 instances, the agencies presumably had no opportunity to choose between rental and purchase as the means of acquisition, since computers meeting their specifications were not commercially available.

Distribution of electronic computers in Federal departments and agencies by size groups and payment plans

Department or agency	Number of computers	Size group			Payment plan	
		Small	Medium	Large	Rental	Purchase
All departments and agencies	524	292	115	117	439	[1] 85
Departments:						
Defense:						
Office of the Secretary	4	2	1	1	4	
Air Force	139	80	29	30	122	17
Army	134	87	32	15	113	21
Navy	87	40	30	17	74	13
Subtotal	364	209	92	63	313	51
Agriculture	4	1	1	2	4	
Commerce	21	9	2	10	13	8
Health, Education, and Welfare	5	1	1	3	5	
Interior	5	4	1		4	1
Justice	1		1		1	
Labor	1	1			1	
Post Office	11	9	2		11	
Treasury	8	6		2	8	
Agencies:						
Atomic Energy Commission	52	21	6	25	37	15
Central Intelligence Agency	3	1	1	1	3	
Civil Aeronautics Board	1	1			1	
Civil Service Commission	1	1			1	
Federal Aviation Agency	12	2	7	3	11	1
General Services Administration	4	4			4	
Housing and Home Finance Agency	1	1			1	
Interstate Commerce Commission	1	1			1	
National Aeronautics and Space Administration	18	12	1	5	12	6
Railroad Retirement Board	1	1			1	
Tennessee Valley Authority	4	3		1	1	3
Veterans' Administration	6	4		2	6	

[1] Includes 17 computers constructed for the Government because they were not commercially available for rent or purchase. The computers and the Federal agencies for which they were constructed are as follows:
Atomic Energy Commission: George, Maniac (two), Stretch, Oracle, Larc.
Department of Commerce (Bureau of Standards): Seac, Pilot.
Federal Aviation Agency: Ambac.
Department of Defense: Oarac (Air Force); Bizmac, Edvac, Ordvac, Dyseac (Army); Raydac, Norc, Narec (Navy).

The information summarized above, as well as that which follows, is based primarily on reports submitted by Federal departments and agencies pursuant to a directive, Bulletin No. 60–4, issued by the Bureau of the Budget. Discussions with representatives of the departments and agencies which are the major users of electronic computers served to clarify and expand these reports, particularly the information pertaining to the application, or utilization, of their computers.

Detailed inventory data

In the following table, computers used by the Government are listed according to department and agency. The location, manufacturer, model number or name, rental or purchase cost, size class, and application are shown for each computer.

Generally, locations are given in terms of metropolitan areas, rather than small, relatively unknown places on the periphery of larger cities, and basic model numbers or names are used because reports received from Federal agencies did not consistently identify variations of the basic models.

Rental figures refer to rental costs for fiscal year 1960. However, if rental was paid for only part of fiscal 1960, the estimated rental for all of fiscal 1961 is shown immediately below in parentheses. This is

done to provide some basis for comparing rental costs of various machines, but it is a measure which should be used cautiously in view of the inability to identify variations in basic models.

Purchase prices shown include capital outlays, exclusive of site preparation, through fiscal 1960. If additional payments are to be made, footnotes will so indicate.

Size class groupings are, as previously explained, on the basis of actual or estimated monthly rentals. Computers which would rent for less than $10,000 a month are in the small category; for $10,000 to $25,000 a month in the medium category; and for more than $25,000 a month in the large category.

Computer applications are divided into two broad categories—scientific and engineering programs and data-processing programs. The latter category is further subdivided into business management and other data-processing programs. Scientific and engineering applications are characterized by complex mathematical computations, difficult to describe because of problems inherent in reducing scientific and technical terminology to lay language. Business management as used here encompasses the establishment and maintenance of records and reports which are used for personnel, budgeting, accounting, inventory control, payroll, labor and cost distribution, and similar activities. Brief descriptions of data-processing programs, other than those for business management purposes, such as processing weather statistics, are provided to illustrate the variety of substantive Federal programs for which electronic computers are being utilized.

Appendix A of this report is a listing, prepared by the Bureau of the Budget, of Government computers by manufacturer and model. For each computer listed, it gives the responsible Federal agency and location. It also points up the predominance of the International Business Machines Corp. as a supplier of electronic computers to the Federal Government, showing that IBM supplies between 55 and 60 percent of all electronic computers used by the Federal departments and agencies. With minor exceptions, due to some differences in definition, appendix A is consistent with the following table which reflects the inventory of electronic computers in the Federal Government as of June 30, 1960.

Inventory of electronic computers in the Federal Government by agency, location,

[Excluding computers for tactical and classified

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Agriculture Department:				
Agricultural Marketing Service.	Washington, D.C.	1	IBM	650
Commodity Stabilization Service.	Evanston, Ill.	1	IBM	650
	Kansas City, Mo.	1	Univac	II
	New Orleans, La.	1	IBM	705
Atomic Energy Commission:				
ACF Industries, Inc.	Albuquerque, N. Mex.	1	IBM	650
		1	Bendix	G-15
Aircraft Reactor Operation Office.	Cincinnati, Ohio	1	IBM	704
		1	IBM	650
		1	IBM	650
Argonne National Laboratories.	Chicago, Ill.	1	IBM	704
		1	Special	GEORGE
		1	IBM	650
		1	Royal McBee	LGP-30
Bendix Aviation Corp.	Kansas City, Mo.	1	IBM	650
		1	IBM	650
		1	Bendix	G-15
Bettes Atomic Power Lab.	Pittsburgh, Pa.	1	Philco	S-2000
		1	IBM	704
		1	Royal McBee	LGP-30
		1	IBM	305 Ramac (Dual)
Dow Chemical Co.	Denver, Colo.	1	Bendix	G-15
DuPont Co.	Augusta, Ga.	1	IBM	650
		1	IBM	650
Edgerton, Germeshausen, and Grier, Inc.	Boston, Mass.	1	Burroughs	E-102
Goodyear Atomic Corp.	Portsmouth, Ohio	1	IBM	650
Hanford Works	Richland, Wash.	1	IBM	709
Idaho Operations Office	Idaho Falls, Idaho	1	IBM	650
Knolls Atomic Power Labtory.	Schenectady, N.Y.	1	IBM	704
		1	Philco	S-2000
Mason and Hanger	Burlington, Iowa	1	Univac	90
	Amarillo, Tex.	1	IBM	650
Midwestern Universities Research Association.	Madison, Wis.	1	IBM	704
New York Operations Office	Princeton, N.J.	1	IBM	650
	New York, N.Y. (N.Y.U.)	1	IBM	704
		1	Univac	I
	New York, N.Y. (Brookhaven).	1	Special	MANIAC
Sandia Base	Albuquerque, N. Mex.	1	Royal McBee	LGP-30
		1	IBM	705
		1	IBM	704
	Livermore, Calif.	1	Underwood	Elecom 120A

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)

uses in the Department of Defense]

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
S	$54,260				X	Preparation of intermediate tabulated material for statistical and research reports on subjects including agricultural prices, cold storage, and wool. Materials include correlation and regression analyses.
M	329,732			X	X	In connection with grain price-support program, producer records are processed to verify quality and class of grain and amount loaned and to create producer settlements.
L	655,626			X	X	Same as above, plus serving as data processing center for Commodity Stabilization Service offices in Dallas, Minneapolis, and Portland.
L	1,575,100			X	X	Process and maintain producer and crop records for cotton price-support program, records for conservation reserve program, and records for dairy herd improvement program.
S	48,660			X		
S	17,820		X			(Also used for machine tool control.)
L	888,000		X			
S	49,000			X		
M	113,000		X	X		
L	651,000		X			
M		$426,087	X			
S	82,000		X	X	X	Periodic weather statistics.
S		69,600	X			
S	71,500			X		
M	280,400			X		
S	13,500		X			Also used for machine tool control.
L	165,000 (824,800)		X			
L	1,107,000		X			
S	15,000		X			
M	27,462 (94,824)			X		
S	32,850		X	X		Do.
M	235,000			X		
S	78,000		X			
S		43,500			X	Reduction of data from film measurement of radiation exposure.
S	46,900		X	X		
L	1,088,279		X	X		
S	60,000		X			
L	818,108		X			
L	280,000 (1,206,000)		X			
S	27,800 (83,400)			X		
S	79,536		X	X		
L	402,064		X			
S	80,500		X	X		
L	860,720		X			
L		196,622	X			
L		621,000	X			
S		60,767	X			
L	806,000			X		
L	393,756		X			
S	0 (6,500)		X			

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
University of California	Los Alamos, N.M.	1	IBM	704
		1	IBM	704
		1	IBM	704
		1	IBM	650
		1	IBM	STRETCH
		1	Special	MANIAC
Union Carbide Nuclear Co.	Oak Ridge, Tenn.	1	IBM	704
		1	Special	ORACLE
	Paducah, Ky.	1	IBM	305 Ramac
University of California	Berkeley, Calif.	1	IBM	650
	San Francisco, Calif.	1	IBM	650
		2	IBM	704
		1	IBM	709
		1	IBM	709
		1	Univac	LARC
Central Intelligence Agency	Washington, D.C.	1	Logistics Research, Inc.	ALWAC III
		1	IBM	650
		1	RCA	501
Civil Aeronautics Board	do	1	Royal McBee	LGP-30
Civil Service Commission	do	1	Bendix	G-15
Commerce Department:				
Bureau of the Census	do	2	Univac	I
		2	Univac	1105
	Chicago, Ill.	1	Univac	1105
	Chapel Hill, N.C.	1	Univac	1105
	Parsons, Kans.	1	IBM	650
Bureau of Public Roads	Washington, D.C.	1	IBM	650
	Vancouver, Wash.	1	IBM	650
Coast and Geodetic Survey	Washington, D.C.	1	IBM	650
National Bureau of Standards	do	1	IBM	704
		1	Special	SEAC
		1	Special	PILOT
	Boulder, Colo.	1	IBM	650
Patent Office	Washington, D.C.	1	IBM	305 Ramac
Weather Bureau	Asheville, N.C.	2	IBM	650
		2	Logistics Research, Inc.	ALWAC
	Washington, D.C.	1	IBM	7090
		1	Bendix	G-15
Federal Aviation Agency	Oklahoma City, Okla.	1	IBM	305 Ramac
		1	IBM	704
	Indianapolis, Ind.	1	IBM	650
	Washington, D.C.	1	Univac	File
	New York City	1	Univac	File
	Boston, Mass.	1	Univac	File
	Cleveland, Ohio	1	Univac	File
	Pittsburgh, Pa.	1	Univac	File

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
L	$112,000	$1,591,000	X			
L	112,000	1,626,000	X			
L	659,000		X			
S	24,000			X		
	(48,000)					
L		[1] 3,022,000	X			
L		126,000	X			
L	662,313		X	X		
L		1,096,050	X			
S	64,466			X		
S	33,500	90,000	X			
M	32,000	214,000	X			
L	1,580,000		X			
L	980,000		X			
L	265,000	1,592,000	X			
L		3,924,000	X			
S	84,200					(Information not available.)
M	114,615					Do.
L	87,251					Do.
	(241,200)					
S	15,420				X	Processing data on airline traffic and financial and operating data.
S	23,796				X	Processing employee service credit claims and annuity and survivor annuity claims.
L		[1][2] 1,781,750			X	Processing statistical data from censuses and surveys (Census Bureau) and income tax returns (Internal Revenue Service).
L		3,400,000			X	Do.
L	190,000				X	Processing statistical data from 1960 Census of Population and Housing.
	(300,000)					
L	190,000				X	Do.
	(300,000)					
S	20,496				X	Processing statistical data from Census of Agriculture.
	(46,000)					
S	78,000			X	X	Data processing for highway traffic and highway engineering.
S	39,000		X			
	(53,300)					
S	48,576		X	X	X	Preparation of geographic position indexes.
L	886,041		X			
L		390,552	X			(Used as a laboratory prototype for computer research and development.)
L		[3] 978,059	X			(To be used for advanced research in computer feasibility studies and other applications.)
M	128,800		X			
S	40,000				X	Patent searching and checking in the steroid and polymerchemical fields.
S	144,000				X	Statistical analysis of weather data.
S		193,000			X	Do.
L	910,000		X		X	Processing of detailed weather observations in connection with research and development in meteorological forecasting.
	(1,151,000)					
S	17,820		X			
S	15,864			X		
	(47,392)					
L	235,360				X	Used for analysis and evaluation of in-flight performance data.
	(559,000)					
M	480,000				X	Used to process flight information required for control of air traffic.
M	480,000				X	Do.
M	480,000				X	Do.
M	480,000				X	Do.
M	480,000				X	Do.
M	480,000				X	Do.

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Commerce Department—Con.				
Federal Aviation Agency	Atlantic City, N.J.	1	Univac	File
		1	Special	AMBAC
		1	IBM	709
		1	Ramo-Wooldridge	RW 300
General Services Administration	Atlanta, Ga.	1	IBM	305 Ramac
	Kansas City, Mo.	1	IBM	305 Ramac
	Dallas, Tex.	1	IBM	305 Ramac
	San Francisco, Calif.	1	IBM	305 Ramac
Health, Education, and Welfare:				
Public Health Service	Washington, D.C.	1	IBM	650
Social Security Administration.	Baltimore, Md.	3	IBM	705
	Chicago, Ill.	1	IBM	305 Ramac
Housing and Home Finance Agency: Federal Housing Administration.	Washington, D.C.	1	IBM	650
Interior Department:				
Bonneville Power Administration.	Portland, Oreg.	1	IBM	650
		1	Bendix	G-15
Bureau of Reclamation	Denver, Colo.	1	IBM	650
	Salt Lake City, Utah	1	Bendix	G-15
Geological Survey	Washington, D.C.	1	Burroughs	220
Interstate Commerce Commission.	do	1	IBM	305 Ramac
Justice Department: Federal Bureau of Investigation.	do	1	IBM	650
Labor Department: Bureau of Labor Statistics.	do	1	IBM	650
National Aeronautics and Space Administration:				
Ames Research Center	Moffett Field, Calif.	1	Burroughs	204
		1	Burroughs	205
		1	IBM	704
Flight Research Center	Bakersfield, Calif.	1	IBM	650
Goddard Space Flight Center.	Washington, D.C.	7	Royal McBee	LGP-30
		1	IBM	709
		1	Burroughs	E-102
	Cape Canaveral, Fla.	1	Burroughs	E-102
	Newport News, Va.	1	IBM	704
Langley Research Center	do	1	IBM	650
Lewis Research Center	Cleveland, Ohio	1	IBM	704
		1	Univac	1103
Post Office Department:				
Bureau of Operations	Boston, Mass.	1	IBM	650
	New York, N.Y.	1	Univac	File
	Philadelphia, Pa.	1	IBM	650
	Cincinnati, Ohio	1	IBM	650
	Richmond, Va.	1	IBM	650
	Atlanta, Ga.	1	IBM	650
	Chicago, Ill.	1	Univac	File
	St Louis, Mo.	1	IBM	650
	Minneapolis, Minn.	1	IBM	650
	Dallas, Tex.	1	IBM	650
	San Francisco, Calif.	1	Burroughs	205

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
M	$300,000					Operations research in air traffic control and air navigation.
L		$1,750,000	X			
L	580,000		X			
S	93,000		X			
S	34,600 (51,900)			X		
S	50,500			X		
S	28,100 (51,900)			X		
S	4,500 (53,700)			X		
M	267,740		X	X		
L	3,103,250				X	Maintenance and certification of earnings records of individuals covered by Social Security Act and production of by-product employment and earning statistics.
S	47,890 (365,400)				X	Establishment and maintenance of benefit payment rolls, certification and control, and byproduct claims statistics.
S	50,844			X	X	Processing of loan reports, insurance claims, recoveries on defaults, premium collections, etc.
S	75,840		X	X		
S		54,234	X		X	Power and weather statistical studies.
S	28,399 (67,044)		X	X		
S	17,820		X	X		
M	155,400 (250,800)		X	X	X	Maintenance of file on gaging stations and preparation of quarterly reports.
S	36,384			X	X	Statistical processing of carload waybill sample, railway and motor carrier financial, operating, and safety reports.
M	302,542			X	X	Compilation of crime statistics.
S	67,956			X	X	Compilation of statistics on manpower and employment, prices, wages, etc.
S		183,173	X	X		
S		295,038	X	X		
L	416,400		X	X		
S	66,660		X			
S	82,620 (5 machines)	106,551 (2 machines)	X			
L	116,580 (699,480)		X			
S		38,300	X			
S		38,300	X			
L	126,000 (432,000)		X			
M	299,190		X			
L	444,420		X			
L		[4] 2,201,251	X			
S	54,096			X	X	Processing and summarization of postmaster accounts and airmail claims.
M	163,500			X	X	Do.
S	64,341			X	X	Do.
S	62,280			X	X	Do.
S	50,396			X	X	Do.
S	60,296			X	X	Do.
M	127,500			X	X	Do.
S	22,000 (53,296)			X	X	Do.
S	51,330			X	X	Do.
S	48,796			X	X	Do.
S	58,500			X	X	Do.

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Railroad Retirement Board	Chicago, Ill	1	IBM	650
Tennessee Valley Authority	Chattanooga, Tenn	1	IBM	704
		2	Underwood	Elecom 120
		1	Royal McBee	LGP-30
Treasury Department:				
Bureau of Public Debt	Parkersburg, W. Va	1	Datamatic	1200
Internal Revenue Service	Kansas City, Mo	1	IBM	650
	Lawrence, Mass	1	IBM	650
	Ogden, Utah	1	IBM	650
Office of the Treasurer	Washington, D.C	1	IBM	705
Coast Guard	do	1	IBM	305 Ramac
	New York, N.Y	1	IBM	305 Ramac
	Baltimore, Md	1	IBM	305 Ramac
Veterans Administration:				
Department of Veterans Benefits.	Chicago, Ill	1	IBM	705
	Philadelphia, Pa	1	IBM	705
Department of Insurance	do	1	IBM	305 Ramac
	St. Paul, Minn	1	IBM	305 Ramac
	Denver, Colo	1	IBM	305 Ramac
Management Services	Washington, D.C	1	IBM	650
Office of Secretary of Defense:				
Defense Atomic Support Agency:				
Headquarters	do	1	Royal McBee	LGP-30
Field Command	Albuquerque, N. Mex	1	IBM	305 Ramac
Armed Forces Supply Support Agency.	Washington, D.C	1	IBM	705
Weapons Systems Evaluation Group.	do	1	IBM	650
Air Force:				
Air Defense Command:				
Headquarters	Colorado Springs, Colo	1	IBM	705
Hamilton Air Force Base	San Francisco, Calif	1	IBM	305 Ramac
Richards-Gebaur Air Force Base.	Kansas City, Mo	1	IBM	305 Ramac
Truax Field	Madison, Wis	1	IBM	305 Ramac
Air Materiel Command:				
Headquarters	Dayton, Ohio	1	IBM	305 Ramac
		1	Univac	I
		1	IBM	705
		1	IBM	650
		1	Royal McBee	LGP-30
Wright-Patterson Air Force Base.	do	1	IBM	650
Sacramento Air Materiel Area.	Sacramento, Calif	4	IBM	650
		1	Univac	File
		1	Univac	1105
Ogden AirMateriel Area	Ogden, Utah	3	IBM	650
		1	IBM	705

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
S	$17,055 (50,000)				X	Processing, maintaining, and extracting data for railroad employee wage accounts.
L		$1,213,679	X	X	X	Processing of hourly-load data for power generator scheduling.
S	340,000	59,628	X	X		
S		15,305	X			
L	1,157,744				X	Operations concerned with issuance and retirement of U.S. Series E Savings Bonds.
S	63,327			X	X	Processing of tax returns and declarations, maintenance of employer file for employment tax control purposes, and compilation of tax statistics.
S	84,436			X	X	Do.
S	63,327			X	X	Do.
L	990,000				X	Payment and reconciliation of Government checks.
S	7,500 (45,000)			X	X	Statistical summaries of Coast Guard search and rescue work, merchant marine data, and boating accidents.
S	47,000				X	Maintenance of vessel movement reporting systems.
S	40,400			X		
L	305,514 (666,576)				X	Establishment and maintenance of master file for disability and death benefits.
L	881,900				X	Processing of National Service Life Insurance accounts.
S	75,012				X	Process insurance applications.
S	59,459				X	Do.
S	59,532				X	Do.
S	48,480			X	X	Date processing on service bureau basis for various VA programs.
S	11,400		X			
S	24,912 (45,756)			X		
L	889,308			X		
M	138,000				X	Weapons systems evaluations.
L	440,110			X		
S	73,368			X		
S	50,910			X		
S	45,147 (67,270)			X		
S	18,640 (44,000)			X		
L	410,742			X	X	Technical failure data analysis.
L	619,752			X	X	Do.
S	54,242			X	X	Do.
S	16,922				X	Operations research on logistics problems.
S	61,376			X		
S	427,937			X		
M	329,475			X	X	Technical studies.
L	448,550 (1,070,900)			X	X	Do.
1M 2S	513,600			X	X	Do.
L	1,060,300			X	X	Do.
L	2,194,964			X	X	Do.

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Air Force—Continued				
Air Materiel Command—Con.				
Oklahoma City Air Materiel Area.	Oklahoma City, Okla	2	IBM	705
		4	IBM	650
Middletown Air Materiel Area.	Harrisburg, Pa	3	IBM	650
		1	IBM	705
Warner Robins Air Materiel Area.	Macon, Ga	4	IBM	650
		1	Univac	File
		1	Univac	1105
Mobile Air Materiel Area.	Mobile, Ala	2	IBM	650
		2	IBM	705
San Antonio Air Materiel Area.	San Antonio, Tex	2	IBM	705
		3	IBM	650
San Bernardino Air Materiel Area.	San Bernardino, Calif	2	IBM	650
		2	IBM	705
		1	Burroughs	205
		1	Burroughs	220
Dayton Air Force Depot	Dayton, Ohio	2	IBM	650
		1	Univac	I
		1	Univac	1105
Memphis Air Force Depot.	Memphis, Tenn	1	IBM	705
		1	IBM	650
Rome Air Materiel Area	Rome, N.Y	1	Univac	1105
		1	Univac	File
		2	IBM	650
Northern Air Materiel Area—Pacific.	Japan	1	IBM	650
Air Materiel Forces—European Area.	France	1	IBM	650
Air Research and Development Command:				
Headquarters	Washington, D.C	1	IBM	650
Armed Services Technical Information Agency.	do	1	Univac	90
Wright Air Development Division.	Dayton, Ohio	1	Burroughs	205
		2	Burroughs	E–101
		1	Univac	1103–A
		1	IBM	650
		1	Burroughs	204
		1	Special	OARAC
Air Force Missile Development Center.	Alamogordo, N. Mex	2	Univac	1103–A
Air Force Flight Test Center.	Muroc, Calif	1	IBM	704
		1	Rea	Readix
		1	IBM	610
Rome Air Development Center.	Rome, N.Y	1	Burroughs	205
		1	Underwood	Elecom 120
		1	Bendix	D–12
Air Force Missile Test Center.	Cocoa, Fla	1	Bendix	G–15
Air Proving Grounds Center.	Valparaiso, Fla	1	IBM	704
		1	IBM	650
		1	Univac	1103
		1	Rea	Readix
		1	Univac	1103–A
Air Force Special Weapons Center.	Albuquerque, N. Mex	1	IBM	650
		1	Bendix	G–15
		1	IBM	704
Air Force Cambridge Research Center.	Bedford, Mass	1	IBM	650
		1	IBM	610
Personnel Laboratory	San Antonio, Tex	1	IBM	650
Air Training Command:				
School of Aviation Medicine.	do	1	NCR	102
		1	NCR	126
Headquarters	Sacramento, Calif	1	Burroughs	220

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
3M 1S	$1,262,633			X	X	Technical studies.
2M 1S	580,196			X	X	Do.
L	433,400 (1,071,400)			X	X	Do.
S	338,304			X	X	Do.
M	374,000			X	X	Do.
L	129,020 (1,026,900)			X	X	Do.
1S 1M	383,900			X	X	Do.
L	1,756,200			X	X	Do.
L	1,830,404			X	X	Do.
S	229,016			X	X	Do.
S	150,100			X	X	Do.
L	1,633,000			X	X	Do.
M	185,800			X	X	Do.
M	219,800 (424,500)			X	X	Do.
S	140,144			X	X	Do.
L	501,310			X	X	Do.
L	238,180 (1,009,200)			X	X	Do.
L	784,345			X	X	Do.
S	72,640			X	X	Do.
L	195,000 (969,900)			X	X	Do.
M	367,400			X	X	Do.
S	190,400			X	X	Do.
S	59,450			X	X	Do.
S	52,015			X	X	Do.
M	168,555			X		
M	31,950 (160,740)			X		
S	118,371			X		
S	29,040		X			
L	684,302		X			
S	48,000				X	Wind tunnel data reduction.
S		(1)			X	Flight and all-weather testing.
S		(1)	X			
L		(1)	X			
L	590,087		X			
S		(1)			X	Aircraft performance data reduction.
S	15,300				X	Do.
M	148,321		X			
S		(1)	X			
S		(1)	X			
S	15,330 (22,800)		X			
L	1,027,345		X	X		
S	59,532		X	X		
L		(1)	X			
S		(1)	X			
L		(1)	X			
S	52,325			X		
S	24,420		X			
L	523,970		X			
M	121,500		X	X		
S	13,800		X			
M	224,184			X		
S		(1)	X			
S		(1)	X			
M	314,702			X		

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Air Force—Continued				
Air University:				
Data Processing Center	Montgomery, Ala	1	Univac	I
Continental Air Command:				
Air Reserve Records Center.	Denver, Colo	1	RCA	501
Headquarters Command, 1100 Support Group.	Washington, D.C	1	Univac	File
Military Air Transport Service Headquarters.	St. Louis, Mo	1	IBM	650
Headquarters Airways Air Communication Services.	do	1	RCA	501
Climatic Center, Air Weather Service.	Asheville, N.C	1	IBM	705
Aeronautical Chart and Information Center.	St. Louis, Mo	1	Burroughs	220
		2	IBM	610
		4	Autonetics	Recomp II
Pacific Air Forces:				
Headquarters	Hawaii	1	IBM	650
Itazuke Airbase	Japan	1	Burroughs	205
Headquarters, 13th Air Force.	Philippine Islands	1	Burroughs	205
Strategic Air Command:				
Headquarters	Omaha, Nebr	1	IBM	650
		1	IBM	650
3902 Combat Support Group.	do	1	IBM	305 Ramac
814 Combat Support Group.	Springfield, Mass	1	IBM	305 Ramac
807 Combat Support Group.	Riverside, Calif	1	IBM	305 Ramac
4238 Combat Support Group.	Shreveport, La	1	IBM	305 Ramac
7 Combat Support Group.	Fort Worth, Tex	1	IBM	305 Ramac
42 Combat Support Group.	Limestone, Maine	1	IBM	305 Ramac
93 Combat Support Group.	Merced, Calif	1	IBM	305 Ramac
72 Combat Support Group.	Overseas	1	IBM	305 Ramac
828 Combat Support Group.	El Paso, Tex	1	IBM	305 Ramac
4060 Combat Support Group.	Bangor, Maine	1	IBM	305 Ramac
4130 Combat Support Group.	Austin, Tex	1	IBM	305 Ramac
821 Combat Support Group.	Rapid City, S. Dak	1	IBM	305 Ramac
816 Combat Support Group.	Altus, Okla	1	IBM	305 Ramac
306 Combat Support Group.	Tampa, Fla	1	IBM	305 Ramac
4228 Combat Support Group.	Columbus, Miss	1	IBM	305 Ramac
92 Combat Support Group.	Spokane, Wash	1	IBM	305 Ramac
4123 Combat Support Group.	Foss, Okla	1	IBM	305 Ramac
856 Combat Support Group.	Marysfield, Calif	1	IBM	305 Ramac
822 Combat Support Group.	Albany, Ga	1	IBM	305 Ramac
6 Combat Support Group.	Roswell, N. Mex	1	IBM	305 Ramac
817 Combat Support Group.	Portsmouth, N.H	1	IBM	305 Ramac
4041 Combat Support Group.	Peru, Ind	1	IBM	305 Ramac

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
L	----------	(1)	----------	X	----------	
M	$188,309 (283,200)	----------	----------	X	----------	
M	291,358	----------	----------	X	----------	
M	261,951	----------	----------	X	----------	
M	55,250 (157,896)	----------	----------	X	----------	
L	275,000 (528,000)	----------	----------	----------	X	Weather data processing.
M	222,611	----------	----------	X	----------	
S	27,600	----------	----------	----------	----------	(Information not available.)
S	----------	(1)	----------	X	----------	
M	158,790	----------	----------	X	----------	
M	20,944 (166,314)	----------	----------	X	----------	
M	10,472 (163,934)	----------	----------	X	----------	
M	289,078	----------	----------	X	----------	
S	49,596	----------	----------	X	----------	
S	66,219	----------	----------	X	----------	
S	81,023	----------	----------	X	----------	
S	73,621	----------	----------	X	----------	
S	78,395	----------	----------	X	----------	
S	67,899	----------	----------	X	----------	
S	73,194	----------	----------	X	----------	
S	76,516	----------	----------	X	----------	
S	53,294 (73,547)	----------	----------	X	----------	
S	52,777 (66,841)	----------	----------	X	----------	
S	50,281 (64,500)	----------	----------	X	----------	
S	52,226 (73,547)	----------	----------	X	----------	
S	22,213 (74,736)	----------	----------	X	----------	
S	50,697 (64,500)	----------	----------	X	----------	
S	49,810 (73,547)	----------	----------	X	----------	
S	43,351 (68,071)	----------	----------	X	----------	
S	42,906 (73,547)	----------	----------	X	----------	
S	37,116 (73,547)	----------	----------	X	----------	
S	35,697 (73,547)	----------	----------	X	----------	
S	40,542 (73,547)	----------	----------	X	----------	
S	2,056 (69,395)	----------	----------	X	----------	
S	2,025 (68,034)	----------	----------	X	----------	
S	2,055 (69,054)	----------	----------	X	----------	

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Air Force—Continued				
Tactical Air Command Headquarters.	Hampton, Va	1	Burroughs	220
U.S. Air Forces—Europe Headquarters.	Germany	1	IBM	650
Headquarters, U.S. Air Force Computer Center.	Washington, D.C	1	IBM	705
		1	Burroughs	E-101
Army:				
Finance:				
Finance Center	Indianapolis, Ind	1	IBM	650
Finance and Accounts Office.	Washington, D.C	1	IBM	305 Ramac
Deputy Chief of Staff for Logistics:				
Chief Chemical Officer:				
Army Chemical Center.	Edgewood, Md	1	Univac	File
Chemical Warfare Laboratories.	do	1	Burroughs	205
Fort Detrick	Fort Detrick, Md	1	Univac	90
Chief of Engineers:				
Engineer Supply Central Office.	St. Louis, Mo	1	IBM	650
Engineer Maintenance Center.	Columbus, Ohio	1	IBM	705
Waterways Experiment Station.	Vicksburg, Miss	1	IBM	650
Omaha Engineer District.	Omaha, Nebr	1	IBM	650
Kansas City Engineer District.	Kansas City, Kans	1	Burroughs	E-102
Washington Engineer District.	Washington, D.C	1	Burroughs	E-102
North Pacific Engineer Division.	Portland, Oreg	1	IBM	650
Ohio River Engineer Division.	Cincinnati, Ohio	1	Burroughs	E-101
Los Angeles Engineer District.	Los Angeles, Calif	1	Bendix	G-15
Tulsa Engineer District.	Tulsa, Okla	1	Burroughs	E-101
Research and Development Laboratories.	Fort Belvoir, Va	1	IBM	650
Snow, Ice, and Permafrost Research Establishment.	Wilmette, Ill	1	Bendix	G-15
Huntington Engineer District.	Huntington, W. Va	1	Burroughs	E-101
Surgeon General: Louisville Medical Depot.	Louisville, Ky	1	IBM	305 Ramac
Chief of Ordnance:				
Anniston Ordnance Depot.	Anniston, Ala	1	IBM	650
Benicia Arsenal	Benicia, Calif	1	IBM	305 Ramac
Letterkenny Ordnance Depot.	Chambersburg, Pa	1	IBM	305 Ramac
Mount Rainier Ordnance Depot.	Tacoma, Wash	1	IBM	305 Ramac
Pueblo Ordnance Depot.	Pueblo, Colo	1	IBM	305 Ramac
Raritan Arsenal	Metuchen, N.J	1	IBM	305 Ramac
Red River Arsenal	Texarkana, Tex	1	IBM	305 Ramac
Picatinny Arsenal	Dover, N.J	1	IBM	650
Watervliet Arsenal	Watervliet, N.Y	1	IBM	650

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
M	$171,100			X		
	(196,120)					
M	207,438			X		
L	623,092			X		
S	14,820				X	Medical reporting.
M	178,720			X		
S	40,427			X		
M	7,595			X		
	(182,280)					
S	55,464		X			
S	6,795		X	X		
	(27,180)					
M	275,500			X		
L	598,960			X		
S	49,540		X			
S	53,300		X			
S	13,440		X			
S	14,400		X	X		
S	60,150		X	X		
S	13,200		X	X		
S	17,820		X			
S	15,180		X			
S	49,236		X	X		
S	17,820		X			
S	15,180		X	X		
S	47,198		X			
M	262,600			X		
S	168,000			X		
S	13,907			X		
	(183,500)					
S	11,168			X		
	(147,500)					
S	41,700			X		
	(183,500)					
S	44,700			X		
	(147,500)					
S	76,400					
	(183,500)					
S	75,800		X			
S	27,625		X	X		
	(51,000)					

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Army—Continued				
Deputy Chief of Staff for Logistics—Continued				
Chief of Ordnance—Continued				
Rocket and Guided Missile Agency.	Huntsville, Ala.	1	Burroughs	205
		1	IBM	610
		1	IBM	610
		1	Underwood	Elecom 120
Ballistic Missile Agency.	do	11	Royal McBee	LGP-30
		1	Bendix	G-15
		5	Burroughs	E-101
		6	Burroughs	205
		1	IBM	610
		2	IBM	704
		1	IBM	705
		1	IBM	709
		1	IBM	7090
Ordnance Tank Automotive Command.	Detroit, Mich.	1	RCA	BIZMAC
White Sands Missile Range.	White Sands, N. Mex.	1	Univac	1103-A
		2	IBM	704
		3	Burroughs	E-101
		2	Bendix	G-15
		2	IBM	610
		1	Royal McBee	LGP-30
Aberdeen Proving Ground.	Aberdeen, Md.	1	Bendix	G-15
		1	Special	EDVAC
		1	Special	ORDVAC
Detroit Arsenal	Centerline, Mich.	1	Burroughs	204
Ordnance Management Engineering Training Agency.	Rock Island, Ill.	1	Royal McBee	LGP-30
Ordnance Weapons Command.	do	1	RCA	501
Watertown Arsenal	Watertown, Mass.	1	Royal McBee	LGP-30
Frankford Arsenal	Philadelphia, Pa.	1	IBM	650
		1	Univac	File
		1	Royal McBee	LGP-30
		1	Burroughs	E-101
		1	NCR	102-D
		1	Bendix	G-15
Quartermaster General:				
Columbus General Depot.	Columbus, Ohio	2	IBM	650
Philadelphia Quartermaster Depot.	Philadelphia, Pa.	2	IBM	650
		1	IBM	650
Richmond Quartermaster Depot.	Richmond, Va.	1	IBM	650
		1	IBM	650
Chief Signal Officer:				
Signal Engineering Agency.	Philadelphia, Pa.	1	Autonetics	Recomp II
Signal Research and Development Laboratory.	Fort Monmouth, N.J.	4	Royal McBee	LGP-30
		1	Burroughs	220
Electronic Proving Ground.	Fort Huachuca, Ariz.	1	IBM	709
		2	Autonetics	Recomp II
		1	Royal McBee	LGP-30
		1	IBM	610
Signal School	Fort Monmouth, N.J.	1	IBM	650
		1	Royal McBee	LGP-30

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
M		(5)	X			
S	$15,180		X			
S	10,120		X			
	(15,180)					
S		(5)	X			
S	217,520		X			
S	24,840		X			
S	72,000		X			
4M } 2S }	585,350		X			
S	15,300		X			
L	1,518,288		X			
L	773,932			X		
L	1,000,566		X			
L	129,918		X			
	(1,000,500)					
L		(5)		X		
L	1,065,384		X			
L	758,250		X			
	(1,434,800)					
S	55,396		X			
S	21,940		X			
	(56,040)					
S	29,376		X			
S	22,000		X			
S	20,855		X			
M		(5)	X			
L		(5)	X			
S		(5)	X			
S		(5)	X			
M	152,977			X		
	(446,400)					
S	18,180		X			
M	270,000			X		
M	144,702			X		
S	3,750		X			
	(15,000)					
S	13,420		X			
S	14,808		X			
S	19,820		X			
IM } IS }	174,077			X		
M	259,348			X		
M	259,648			X		
M	156,385			X		
M	235,267			X		
S		(5)	X			
S		(5)	X			
M	140,735		X			
L	752,220				X	Electronic data processing systems development for field armies.
S		(5)			X	Do.
S		(5)			X	Do.
S		(5)			X	Do.
S	67,018				X	Training records.
S	15,250				X	Do.

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Army—Continued				
Chief Signal Office—Con.				
White Sands Signal Agency.	White Sands, N. Mex.	2	Royal McBee	LGP-30
		1	Special	DYSEAC
Signal Supply Agency	Philadelphia, Pa.	1	IBM	705
Tobyhanna Signal Depot.	Tobyhanna, Pa.	1	IBM	650
Decatur Signal Depot	Decatur, Ill.	1	IBM	650
Sacramento Signal Depot.	Sacramento, Calif.	1	IBM	650
Lexington Signal Depot	Lexington, Ky.	1	IBM	650
Chief of Transportation:				
Transportation Materiel Command.	St. Louis, Mo.	2	IBM	650
		1	IBM	705
Military Traffic Management Agency.	Washington, D.C.	1	Univac	File
Transportation Research Command.	Fort Eustis, Va.	1	IBM	610
Deputy Chief of Staff for Personnel:				
Adjutant General:				
Personnel Research Branch.	Washington, D.C.	1	Logistics Research, Inc.	ALWAC III
Data Processing Branch.	do	1	IBM	705
United States Continental Army Command.:				
Headquarters	Fort Monroe, Va.	1	Royal McBee	LGP-30
2a Army: Fort Meade	Fort Meade, Md.	1	Univac	File
4th Army:				
Artillery and Missile School.	Fort Sill, Okla.	1	Bendix	G-15
Air Defense Board	Fort Bliss, Tex.	1	IBM	650
5th Army: Command and General Staff College.	Fort Leavenworth Kans.	1	Bendix	G-15
6th Army: Combat Development and Experimentation Center.	Fort Ord, Calif.	1	Autonetics	Recomp II
U.S. Army, Europe:				
7th Army Stock Control Center.	Germany	1	IBM	650
Engineer Supply Control Agency.	France	1	IBM	650
Ordnance Supply Control Agency.	do	2	IBM	305 Ramac
Quartermaster Supply Center.	Germany	1	IBM	650
Signal Supply Central Agency.	France	1	IBM	305 Ramac
U.S. Army, Pacific: U.S. Army, Hawaii.	Hawaii	1	IBM	650
Navy:				
Bureau of Supplies and Accounts:				
Ships Parts Control Center.	Mechanicsburg, Pa.	1	IBM	705
Ordnance Supply Office	do	2	Burroughs	220
Aviation Supply Office	Philadelphia, Pa.	1	IBM	650
		2	IBM	705
Electronic Supply Office	Great Lakes, Ill.	1	Univac	II
General Stores Supply Office.	Philadelphia, Pa.	1	IBM	650
Naval Supply Center	Norfolk, Va.	1	Burroughs	220
Do	Oakland, Calif.	1	IBM	650
Do	Bayonne, N.J.	1	IBM	650
Do	San Diego, Calif.	1	IBM	650
Naval Supply Depot	Newport, R.I.	1	IBM	305 Ramac

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960) Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
S		(5)	X			
M		(5)	X			
L	$644,290			X		
M	200,000			X		
M	205,000			X		
M	207,000			X		
M	196,000			X		
M	494,232			X		
L	695,000 (1,190,000)			X		
M	174,630				X	Traffic management statistics.
S	3,980 (13,980)		X			
S		(5)			X	Personnel research statistics.
L	490,000			X		
S	18,180		X			
M	150,885 (201,180)			X		
S	24,300		X			
S	46,476		X			
S	5,400 (21,600)		X			
S		(5)	X		X	Statistical studies.
M	283,000			X		
S	84,417			X		
S	15,572 (112,118)			X		
M	36,800 (261,400)			X		
S	13,000 (80,000)			X		
M	167,904			X		
L	840,000			X		
M	282,000 (457,000)			X		
S	48,700			X		
L	1,388,300			X		
L	662,000			X		
S	62,300			X		
M	216,000			X		
S	83,500			X		
S	68,800			X		
S	62,500			X		
S	69,300			X		

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Navy—Continued				
Bureau of Ships:				
Headquarters	Washington, D.C	2	IBM	650
Boston Naval Shipyard	Boston, Mass	1	Burroughs	205
Charleston Naval Shipyard.	Charleston, S.C	1	IBM	305 Ramac
		1	Bendix	G–15
New York Naval Shipyard.	Brooklyn, N.Y	1	IBM	650
Norfolk Naval Shipyard	Portsmouth, Va	1	IBM	650
		1	IBM	610
Long Beach Naval Shipyard.	Long Beach, Calif	1	Burroughs	220
Mare Island Naval Shipyard.	Vallejo, Calif	1	IBM	705
Philadelphia Naval Shipyard.	Philadelphia, Pa	1	Univac	II
Portsmouth Naval Shipyard.	Portsmouth, N.H	1	IBM	650
Puget Sound Naval Shipyard.	Bremerton, Wash	1	IBM	650
San Francisco Naval Shipyard.	San Francisco, Calif	1	Univac	File
David Taylor Model Basin.	Washington, D.C	1	IBM	704
		1	Univac	I
Electronics Laboratory	San Diego, Calif	1	Burroughs	220
Engineering Experiment Station.	Annapolis, Md	1	Bendix	G–15
Mine Defense Laboratory.	Panama City, Fla	1	Burroughs	205
		1	Bendix	G–15
Radiological Defense Laboratory.	San Francisco, Calif	1	Burroughs	205
Underwater Sound Laboratory.	New London, Conn	1	Burroughs	205
Bureau of Weapons:				
Naval Air Material Center.	Philadelphia, Pa	1	IBM	610
Bureau of Weapons Headquarters.	Washington, D.C	1	NCR	107
		1	Bendix	G–15
		1	IBM	650
		1	RCA	501
Naval Air Development Center.	Johnsville, Pa	1	IBM	650
		1	Bendix	G–15
Naval Postgraduate School.	Monterey, Calif	1	CDC	1604
Naval Air Turbine Test Station.	Trenton, N.J	1	Bendix	G–15
Naval Air Facility	Indianapolis, Ind	1	IBM	650
Naval Weather Research Facility.	Norfolk, Va	1	Bendix	G–15
Naval Air Test Center	Patuxent River, Md	1	Burroughs	204
		1	Burroughs	E101
Naval Missile Facility	Point Arguello, Calif	1	IBM	709
Pacific Missile Range	Point Mugu, Calif	1	IBM	650
		1	IBM	709
		1	IBM	610
		1	Raytheon	RAYDAC
		1	Bendix	G–15
Naval Ammunitions Depot.	Crane, Ind	1	IBM	610
Applied Physics Laboratory.	Silver Spring, Md	1	IBM	650
		1	Univac	1103–A
Naval Ordnance Laboratory.	Corona, Calif	1	Bendix	G–15
		1	Burroughs	205
Naval Ordnance Test Station.	China Lake, Calif	1	IBM	610
		1	IBM	709
Naval Ordnance Laboratory.	White Oak, Md	1	IBM	704

See footnotes at end of table, p. 84.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
M	$260,331			X		
M	220,000		X	X		
S	63,000			X		
S	18,000		X			
S	68,000			X		
M	200,000			X		
S	14,000		X			
M	47,000			X		
	(338,000)					
L	589,000			X		
L	439,000		X	X		
S	64,000		X	X		
S	68,000		X	X		
M	219,000			X		
L	1,098,100		X			
L		(1)	X			
M	213,318		X			
S	27,459		X			
M	104,396		X			
S		(1)	X			
S	120,000		X			
S	93,929		X			
S	13,800			X		
S		(1)	X			
S		(1)	X			
M	134,444		X			
M	212,000			X		
M	126,000		X			
S		(1)	X			
M		(1)	X			
S		(1)	X			
M	100,000		X			
S	25,000		X			
S		(1)	X			
S		(1)	X			
L	522,000		X			
M	225,000		X			
L	468,000		X			
	(881,990)					
S	14,000		X			
L		(1)	X			
S	7,320		X			
	(29,280)					
S	13,800				X	Quality evaluation.
S	48,200		X			
L	533,600		X			
S	5,000		X			
	(21,000)					
M		(1)	X			
S	15,000		X			
L	416,000		X			
	(950,000)					
L	722,000		X			

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

Inventory of electronic computers in the Federal Government by agency, location,

Agency	Location	Computer		
		Quantity	Manufacturer	Model
Navy—Continued				
Bureau of Weapons—Con.				
Naval Underwater Ordnance Station.	Newport, R.I.	1	IBM	650
Naval Weapons Laboratory.	Dahlgren, Va.	1	Special	NORC
Bureau of Naval Personnel:				
Headquarters	Washington, D.C.	1	IBM	705
		1	IBM	650
Personnel Accounting Machine Installation, Atlantic Fleet.	Norfolk, Va.	1	IBM	650
Personnel Accounting Machine Installation, Pacific Fleet.	San Diego, Calif.	1	IBM	650
Personnel Accounting Machine Installation, Continental United States.	Bainbridge, Md.	1	IBM	650
Naval Examining Center.	Great Lakes, Ill.	1	IBM	650
Bureau of Yards and Docks:				
Headquarters	Washington, D.C.	1	NCR	304
		1	Burroughs	E102
Construction Battalion Center.	Port Hueneme, Calif.	1	IBM	705
Naval Civil Engineering Laboratory.	do	1	Royal McBee	LGP-30
Marine Corps:				
Marine Corps Supply Activity.	Philadelphia, Pa.	1	Univac	File
Marine Corps Base, Camp Lejeune.	Camp Lejeune, N.C.	1	NCR	304
Marine Corps Base, Camp Pendleton.	Camp Pendleton, Calif.	1	NCR	304
Marine Corps Headquarters.	Washington, D.C.	1	NCR	304
Marine Corps Supply Center.	Albany, Ga.	1	Univac	File
Do	Barstow, Calif.	1	Univac	File
Executive Office of the Secretary: Administrative Office.	Washington, D.C.	1	IBM	650
Office of Naval Research: Navy Research Laboratory.	do	1	Special	NAREC
Naval Operations:				
Office of the Chief	do	1	IBM	650
Naval Observatory	do	1	IBM	650
Hydrographic Office	do	1	Burroughs	205
		1	Bendix	G-15
		1	Royal McBee	LGP-30

[1] Partial payment only; total will be $4,300,000.
[2] Includes $216,750 from Internal Revenue Service for a share of equipment time.
[3] Construction costs to date; final cost is estimated at $1,528,059.
[4] Includes site preparation.
[5] Price not obtained.

make and model, size class, cost, and applications (as of June 30, 1960)—Continued

Size class	Cost		Applications—			
				Data processing		
	Rental in fiscal 1960*	Purchase price	Scientific and engineering programs	Business management programs	Other programs	Summary description of other programs
S	$22,000	----------	X	----------	----------	
	(88,000)					
L	----------	(5)	X	----------	----------	
L	798,377	----------	----------	X	----------	
S	33,722	----------	----------	X	----------	
M	271,405	----------	----------	X	----------	
M	318,315	----------	----------	X	----------	
M	296,534	----------	----------	X	----------	
S	57,799	----------	----------	X	----------	
M	37,060	----------	----------	X	----------	
	(178,860)					
S	4,400	----------	X	----------	----------	
L	442,508	----------	----------	X	----------	
S	13,126	----------	X	----------	----------	
M	339,192	----------		X		
M	94,265	----------				
	(184,900)	----------		X		
M	109,504	----------		X		
	(184,090)					
M	51,425	----------		X		
	(200,508)					
M	312,448	----------		X		
M	320,673	----------		X		
S	49,296	----------	X	X		
M	----------	(5)	X			
S	48,000	----------		X	X	Flight activity status and naval intelligence.
S	45,000	----------	X			
M	129,900	----------	X			
S	18,000	----------	X			
S	19,500	----------	X			

*When fiscal 1960 rental is for less than the full year, estimated fiscal 1961 rentals are shown immediately below in parentheses.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)

Computer	Department	Bureau, office, or command	Location
Logistics Research, Inc.:			
Allw 3	CIA	Central Intel Agency	Washington.
Allw 3	Commerce	Weather	Asheville, N.C.
Alwac 3	Army	Pers Res Branch TAGO	Washington.
Bizmac [1]	do	Ord Tank Autom Cmd	Detroit.
Burroughs Corp.:			
Bur 204	AF	Wright Air Dev Div	Wright-Patterson AFB, Ohio.
Bur 204	Army	Detroit Arsenal	Center Line, Mich.
Bur 204	NASA	Ames Research Center	Moffett Field, Calif.
Bur 204	Navy	Naval Air Test Cent	Patuxent River, Md.
Bur 205	AF	Hq 13th Air Force	Overseas.
Bur 205	AF	Itazuke Airbase	Do.
Bur 205	AF	Rome Air Dev Center	Griffiss AFB, N.Y.
Bur 205	AF	San Bernardino Ama	San Bernardino, Calif.
Bur 205	AF	Wright Air Dev Div	Wright-Patterson AFB, Ohio.
Bur 205	Army	Ballistic Missile Ag	Huntsville, Ala.
Bur 205	do	do	Do.
Bur 205	do	do	Do.
Bur 205	do	do	Do.
Bur 205	do	do	Do.
Bur 205	do	do	Do.
Bur 205	do	Chem Warfare Lab	Edgewood, Md.
Bur 205	do	Rocket Missile Agcy	Huntsville, Ala.
Bur 220	Interior	Geological Survey	Washington.
Bur 205	NASA	Ames Research Center	Moffett Field, Calif.
Bur 205	Navy	Hydrographic Office	Suitland, Md.
Bur 205	do	Mine Defense Lab	Panama City, Fla.
Bur 205	do	Naval Ordnance Lab	Corona, Calif.
Bur 205	do	Naval Shipyard	Boston.
Bur 205	do	Radiological Def Lab	San Francisco.
Bur 205	do	Sub & Reactor Pts So	Mechanicsburg, Pa.
Bur 205	do	Underwater Sound Lab	New London.
Bur 205	Post Office	Operations	San Francisco.
Bur 220	AF	Aero Chart Info Cent	St. Louis.
Bur 220	AF	Hq Air Training Cmd	Randolph AFB, Tex.
Bur 220	AF	Hq Tactical Air Comm	Langley AFB, Va.
Bur 220	AF	San Bernardino AMA	San Bernardino, Calif.
Bur 220	Army	Signal R & D Lab	Philadelphia.
Bur 220	Navy	Nav Electronics Lab	San Diego, Calif.
Bur 220	do	Naval Shipyard	Long Beach, Calif.
Bur 220	do	Naval Supply Center	Norfolk.
Bur 220	do	Ordnance Supply Off	Mechanicsburg, Pa.
Bur E101	AF	Hq USAF Computer Cen	Washington.
Bur E101	AF	Wright Air Dev Div	Wright-Patterson AFB, Ohio.
Bur E101	AF	do	Do.
Bur E101	Army	Ballistic Missile Ag	Huntsville, Ala.
Bur E101	do	do	Do.
Bur E101	do	do	Do.
Bur E101	do	do	Do.
Bur E101	do	do	Do.
Bur E101	do	Eng Dist Huntington	Huntington, W. Va.
Bur E101	do	Eng Dist Phila	Philadelphia.
Bur E101	do	Eng Dist Tulsa	Tulsa.
Bur E101	do	Frankford Arsenal	Philadelphia.
Bur E101	do	Ohio River Engr Div	Cincinnati.
Bur E101	do	S Atl Engr Div Lab	Atlanta.
Bur E101	do	White Sands Miss Rge	White Sands, N. Mex.
Bur E101	do	do	Do.
Bur E101	do	do	Do.
Bur E102	AEC	Edgerton et al., Inc.	Boston.
Bur E102	Army	Eng Dist Kansas City	Kansas City, Kans.
Bur E102	do	Eng Dist Washington	Washington.
Bur E102	NASA	Goddard Space Flt Ct	Cape Canaveral.
Bur E102	NASA	do	Washington.
Bur E102	Navy	BuDocks Hq	Do.
Royal McBee Corp.:			
LGP 30	AF	Hq Air Materiel Cmd	Wright-Patterson AFB, Ohio.
LGP 30	AEC	Argonne Laboratory	Chicago.
LGP 30	AEC	Bettis Power Lab	Pittsburgh.
LGP 30	AEC	Sandia Base	Albuquerque.
LGP 30	Army	Ballistic Missile Ag	Huntsville, Ala.
LGP 30	do	do	Do.
LGP 30	do	do	Do.
LGP 30	do	do	Do.

[1] Specially constructed to Government specifications.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
Royal McBee Corp—Con.			
LGP 30	Army	Ballistic Missile Ag	Huntsville, Ala.
LGP 30	do	do	Do.
LGP 30	do	do	Do.
LGP 30	do	do	Do.
LGP 30	do	do	Do.
LGP 30	do	do	Do.
LGP 30	do	do	Do.
LGP 30	do	Electronic Prov Grnd	Fort Huachuca, Ariz.
LGP 30	do	Frankford Arsenal	Philadelphia.
LGP 30	do	Hq US Cont Army Cmd	Fort Monroe, Va.
LGP 30	do	Mobile Eng District	Mobile.
LGP 30	do	Ord Mgmt Engr Tng Ag	Rock Island, Ill.
LGP 30	do	White Sands Miss Rge	White Sands, N. Mex.
LGP 30	do	White Sands Sig Agy	Do.
LGP 30	do	do	Do.
LGP 30	CAB	Carrier Accounts Off	Washington.
LGP 30	NASA	Goddard Space Flt Ct	Do.
LGP 30	NASA	do	Do.
LGP 30	NASA	do	Do.
LGP 30	NASA	do	Do.
LGP 30	NASA	do	Do.
LGP 30	NASA	do	Do.
LGP 30	NASA	do	Do.
LGP 30	Navy	Hydrographic Office	Suitland, Md.
LGP 30	do	Naval Civil Engr Lab	Port Hueneme, Calif.
LGP 30	OSD	Hq Def Atomic Spt Ag	Washington.
LGP 30	TVA	Tenn Valley Auth	Chattanooga.
Bendix Aviation Corp.:			
BX 902	AF	Air Proving Gnd Cent	Eglin AFB, Fla.
BX D12	AF	Rome Air Dev Center	Griffiss AFB, N.Y.
BX G15	AF	AF Flight Test Cent	Edwards AFB, Calif.
BX G15	AF	AF Missile Test Cent	Patrick AFB, Fla.
BX G15	AF	AF Spec Weapons Cent	Kirtland AFB, N.Mex.
BX G15	AEC	ACF Industries	Albuquerque.
BX G15	AEC	Bendix Aviation Corp	Kansas City.
BX G15	AEC	Dow Chemical Co	Denver.
BX G15	Army	Aberdeen Proving Grd	Aberdeen, Md.
BX G15	do	Artillery & Miss Sch	Fort Sill, Okla.
BX G15	do	Ballistic Missile Ag	Huntsville, Ala.
BX G15	do	Cmd & Gen Staff Coll	Fort Leavenworth, Kans.
BX G15	do	Eng Dist Los Angeles	Los Angeles.
BX G15	do	Frankford Arsenal	Philadelphia.
BX G15	do	Snow & Ice Res Estab	Wilmette, Ill.
BX G15	do	White Sands Miss Rge	White Sands, N.Mex.
BX G15	do	do	Do.
BX G15	Commerce	Weather	Washington.
BX G15	CSC	Retirement and Insur	Do.
BX G15	Interior	Bonneville Power Adm	Portland.
BX G15	do	Reclamation	Salt Lake City.
BX G15	Navy	BuWeps Hq	Washington.
BX G15	do	Eng Experimental Sta	Annapolis, Md.
BX G15	do	Hydrographic Office	Suitland, Md.
BX G15	do	Mine Defense Lab	Panama City, Fla.
BX G15	do	Nav Weather Res Fac	Norfolk.
BX G15	do	Naval Air Dev Cent	Johnsville, Pa.
BX G15	do	Naval Ordnance Lab	Corona, Calif.
BX G15	do	Naval Shipyard	Charleston, S.C.
BX G15	do	Pacific Missile Rge	Point Mugu, Calif.
Control Data Corp.:			
CDC 1604	do	Naval Postgrad Sch	Monterey, Calif.
Datamatic Corp.:			
DTM 1000	Treasury	Public Debt	Parkersburg, W. Va.
Special machines:			
Dyseac[1]	Army	White Sands Sig Agy	White Sands, N. Mex.
Edvac[1]	do	Aberdeen Proving Grd	Aberdeen, Md.
George[1]	AEC	Argonne Laboratory	Chicago.
International Business Machines Corp.:			
IBM 1401	NASA	Goddard Space Flt Ct	Washington.
IBM 305	Navy	Naval Shipyard	Charleston, S.C.
IBM 305R	AF	306 Combat Supp Grp	MacDill AFB, Fla.
IBM 305R	AF	3902 Combat Supp Grp	Offutt, AFB, Nebr.
IBM 305R	AF	4060 Combat Supp Grp	Dow AFB, Maine.
IBM 305R	AF	4123 Combat Supp Grp	Clinton-Sher, Okla.
IBM 305R	AF	4130 Combat Supp Grp	Bergstrom AFB, Tex.
IBM 305R	AF	42 Combat Supp Grp	Loring AFB, Maine.
IBM 305R	AF	4228 Combat Supp Grp	Columbus AFB, Miss.

[1] Specially constructed to Government specifications.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
International Business Machines Corp.—Con.			
IBM 305R	AF	4238 Combat Supp Grp	Barksdale AFB, La.
IBM 305R	AF	7 Combat Supp Grp	Carswell AFB, Tex.
IBM 305R	AF	72 Combat Supp Grp	Overseas.
IBM 305R	AF	807 Combat Supp Grp	March AFB, Calif.
IBM 305R	AF	814 Combat Supp Grp	Westover AFB, Mass.
IBM 305R	AF	816 Combat Supp Grp	Altus AFB, Okla.
IBM 305R	AF	821 Combat Supp Grp	Ellsworth AFB, S. Dak.
IBM 305R	AF	822 Combat Supp Grp	Turner AFB, Ga.
IBM 305R	AF	828 Combat Supp Grp	Biggs AFB, Tex.
IBM 305R	AF	856 Combat Supp Grp	Beale AFB, Calif.
IBM 305R	AF	92 Combat Supp Grp	Fairchild AFB, Wash.
IBM 305R	AF	93 Combat Supp Grp	Castle AFB, Calif.
IBM 305R	AF	Hamilton AFB	Hamilton AFB, Calif.
IBM 305R	AF	Hq Air Materiel Cmd	Wright-Patterson, AFB, Ohio.
IBM 305R	AF	Richards-Gebaur AFB	AFB, Missouri.
IBM 305R	AF	Truax Field	Madison, Wis.
IBM 305R	AEC	Bettis Power Lab	Pittsburgh.
IBM 305R	AEC	Union Carbide Nuc Co	Paducah, Ky.
IBM 305R	Army	Benicia Arsenal	Benicia, Calif.
IBM 305R	do	Fin Accts Off Army	Washington.
IBM 305R	do	Letterkenny Ord Dep	Chambersburg, Pa.
IBM 305R	do	Los Angeles Ord Dist	Los Angeles.
IBM 305R	do	Louisville Med Depot	Louisville.
IBM 305R	do	Mt Rainier Ord Depot	Tacoma, Wash.
IBM 305R	do	Ord Supp Cont Agency	Maison Forte, France.
IBM 305R	do	do	Do.
IBM 305R	do	Pueblo Ord Depot	Pueblo, Col.
IBM 305R	do	Raritan Arsenal	Metuchen, N.J.
IBM 305R	do	Red River Arsenal	Texarkana, Tex.
IBM 305R	do	Signal Sup Con Agcy	Poitiers, France.
IBM 305R	Commerce	Patent Office	Washington.
IBM 305R	FAA	Aeronautical Center	Oklahoma City.
IBM 305R	GSA	Region 4	Atlanta.
IBM 305R	GSA	Region 6	Kansas City.
IBM 305R	GSA	Region 7	Dallas.
IBM 305R	GSA	Region 9	San Francisco.
IBM 305R	HEW	Social Security Adm	Chicago.
IBM 305R	ICC	Transport Economics	Washington.
IBM 305R	Navy	Naval Supply Depot	Newport, R.I.
IBM 305R	OSD	Field Command DASA	Albuquerque.
IBM 305R	Treasury	Coast Guard	Washington.
IBM 305R	do	do	New York.
IBM 305R	do	do	Baltimore.
IBM 305R	VA	Insurance	Philadelphia.
IBM 305R	VA	do	St. Paul.
IBM 305R	VA	do	Denver.
IBM 610	AF	Aero Chart Info Cent	St. Louis.
IBM 610	AF	do	Do.
IBM 610	AF	AF Cambridge Res Cent	Bedford, Mass.
IBM 610	AF	AF Flight Test Cent	Edwards AFB, Calif.
IBM 610	Army	Ballistic Missile Ag	Huntsville, Ala.
IBM 610	do	Rocket Missile Agcy	Do.
IBM 610	do	do	Do.
IBM 610	do	Transp Research Cmd	Fort Eustis, Va.
IBM 610	do	White Sands Miss Rge	White Sands, N. Mex.
IBM 610	do	do	Do.
IBM 610	Navy	Naval Air Mater Cent	Philadelphia.
IBM 610	do	Naval Ammun Depot	Crane, Ind.
IBM 610	do	Naval Ord Test Sta	China Lake, Calif.
IBM 610	do	Naval Shipyard	Portsmouth, Va.
IBM 610	do	Pacific Missile Rge	Point Mugu, Calif.
IBM 650	AF	AF Cambridge Res Cen	Bedford, Mass.
IBM 650	AF	AF Spec Weapons Cent	Kirtland AFB, N. Mex.
IBM 650	AF	Air Proving Gnd Cent	Eglin AFB, Fla.
IBM 650	AF	AM Forces Europe	Overseas.
IBM 650	AF	Dayton AF Depot	Dayton.
IBM 650	AF	do	Do.
IBM 650	AF	Hq Air Materiel Cmd	Wright-Patterson AFB, Ohio.
IBM 650	AF	Hq Air R. and D. Cmd	Washington.
IBM 650	AF	Hq Mil Air Trans Ser	Scott AFB, Ill.
IBM 650	AF	Hq Pac Air Forces	Overseas.
IBM 650	AF	Hq Strategic Air Com	Offutt AFB, Nebr.
IBM 650	AF	do	Do.
IBM 650	AF	Hq U.S. Air Forces Eur	Overseas.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
International Business Machines Corp.—Con.			
IBM 650	AF	Memphis AF Depot	Memphis.
IBM 650	AF	Middletown AMA	Olmsted AFB, Pa.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	Mobile AMA	Mobile, Ala.
IBM 650	AF	do	Do.
IBM 650	AF	Northern AMA Pacific	Overseas.
IBM 650	AF	Ogden AMA	Ogden, Utah.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	Oklahoma City AMA	Oklahoma City.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	Personnel Laboratory	Lackland AFB, Tex.
IBM 650	AF	Rome AMA	Rome, N.Y.
IBM 650	AF	do	Do.
IBM 650	AF	Sacramento AMA	Sacramento, Calif.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	San Antonio AMA	San Antonio.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	San Bernardino AMA	San Bernardino, Calif.
IBM 650	AF	do	Do.
IBM 650	AF	Warner Robins AMA	Robins AFB, Ga.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	do	Do.
IBM 650	AF	Wright Air Dev Div	Wright-Patterson AFB, Ohio.
IBM 650	AF	Wright-Patterson AFB	Dayton, Ohio.
IBM 650	AEC	ACF Industries	Albuquerque.
IBM 650	AEC	Albuquerque Oper Off	Los Alamos.
IBM 650	AEC	Argonne Laboratory	Chicago.
IBM 650	AEC	Bendix Aviation Corp	Kansas City.
IBM 650	AEC	do	Do.
IBM 650	AEC	Bettis Power-Lab	Pittsburgh.
IBM 650	AEC	E. I. duPont Co	Augusta, Ga.
IBM 650	AEC	do	Do.
IBM 650	AEC	General Electric Co	Cincinnati.
IBM 650	AEC	do	Do.
IBM 650	AEC	Goodyear Atomic Corp	Portsmouth, Ohio.
IBM 650	AEC	Idaho Operations Off	Idaho Falls, Idaho.
IBM 650	AEC	Lawrence Rad Lab	San Francisco.
IBM 650	AEC	do	Do.
IBM 650	AEC	Mason & Hanger, Inc	Amarillo, Tex.
IBM 650	AEC	NY Operations Office	Princeton, N.J.
IBM 650	Agriculture	Agri Marketing Serv	Washington.
IBM 650	do	Comm Stab Service	Evanston.
IBM 650	Army	Electronic Prov Grnd	Fort Huachuca, Ariz.
IBM 650	do	7th Army Stk Con Cen	Zweibrucken, Germany.
IBM 650	do	Air Defense Board	Fort Bliss, Tex.
IBM 650	do	Anniston Ord Depot	Anniston, Ala.
IBM 650	do	Columbus General Dep	Columbus.
IBM 650	do	do	Do.
IBM 650	do	Decatur Signal Dep	Decatur, Ill.
IBM 650	do	Eng Dist San Fran	San Francisco.
IBM 650	do	Eng District Omaha	Omaha.
IBM 650	do	Eng R & D Laboratrs	Fort Belvoir, Va.
IBM 650	do	Eng Supp Cont Agency	Maison Forte, France.
IBM 650	do	Eng Supply Cont Off	St. Louis.
IBM 650	do	Finance Cent U.S. Army	Indianapolis.
IBM 650	do	Frankford Arsenal	Philadelphia.
IBM 650	do	Gt Lakes Reg Stat Of	Chicago.
IBM 650	do	Lexington Signal Dep	Lexington, Ky.
IBM 650	do	N Pac Eng District	Portland, Oreg.
IBM 650	do	Philadelphia QM Dep	Philadelphia.
IBM 650	do	do	Do.
IBM 650	do	do	Do.
IBM 650	do	Picatinny Arsenal	Dover, N.J.
IBM 650	do	do	Do.
IBM 650	do	QM Supply Center	Giessen, Germany.
IBM 650	do	Richmond QM Depot	Richmond.
IBM 650	do	do	Do.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
International Business Machines Corp.—Con.			
IBM 650	Army	Sacramento Sig Dep	Sacramento.
IBM 650	do	Signal school	Fort Monmouth, N.J.
IBM 650	do	Tobyhanna Signal Dep	Tobyhanna, Pa.
IBM 650	do	Transp Materiel Cmd	St. Louis.
IBM 650	do	do	Do.
IBM 650	do	US Army Hawaii	U.S. Army Pacific.
IBM 650	do	Watervliet Arsenal	Watervliet, N.Y.
IBM 650	do	Waterways Exper Sta	Vicksburg, Miss.
IBM 650	CIA	Central Intel Agency	Washington.
IBM 650	Commerce	Census	Parsons, Kans.
IBM 650	do	Coast and Geodetic	Washington.
IBM 650	do	Nat Bur Standards	Boulder, Colo.
IBM 650	do	Public Roads	Washington.
IBM 650	do	do	Vancouver, Wash.
IBM 650	do	Weather	Asheville, N.C.
IBM 650	do	do	Do.
IBM 650	FAA	Air Traffic Mgt	Washington and field.
IBM 650	HEW	Public Health Serv	Washington.
IBM 650	HHFA	Federal Housing Adm	Do.
IBM 650	Interior	Bonneville Power Adm	Portland.
IBM 650	do	Reclamation	Denver.
IBM 650	Justice	FBI	Washington.
IBM 650	Labor	Labor Statistics	Do.
IBM 650	NASA	Flight Research Cent	Bakersfield, Calif.
IBM 650	NASA	Langley Research Ct	Newport News.
IBM 650	Navy	Admin Office Exos	Washington.
IBM 650	do	Applied Physic Lab	Silver Springs, Md.
IBM 650	do	Aviation Supply Off	Philadelphia.
IBM 650	do	BuPers Hq	Washington.
IBM 650	do	BuShips Hq	Do.
IBM 650	do	BuWeps Hq	Do.
IBM 650	do	Chief Nav Operations	Do.
IBM 650	do	Electronics Supp Off	Great Lakes, Ill.
IBM 650	do	Gen Stores Supp Off	Philadelphia.
IBM 650	do	Nav Undrwater Ord St	Newport, R.I.
IBM 650	do	Naval Air Dev Cent	Johnsville, Pa.
IBM 650	do	Naval Air Facility	Indianapolis.
IBM 650	do	Naval Examining Cent	Great Lakes, Ill.
IBM 650	do	Naval Observatory	Washington.
IBM 650	do	Naval Shipyard	Brooklyn.
IBM 650	do	do	Portsmouth, Va.
IBM 650	do	do	Portsmouth, N.H.
IBM 650	do	do	Bremerton, Wash.
IBM 650	do	Naval Supply Center	Oakland, Calif.
IBM 650	do	do	Bayonne, N.J.
IBM 650	do	do	San Diego, Calif.
IBM 650	do	Ordnance Supply Off	Mechanicsburg, Pa.
IBM 650	do	Pacific Missile Rge	Point Mugu, Calif.
IBM 650	do	PAMI-CONUS	Bainbridge, Md.
IBM 650	do	do	Do.
IBM 650	do	PAMI-LANTFLT	Norfolk.
IBM 650	do	PAMI-PACFLT	San Diego, Calif.
IBM 650	OSD	Weapon Sys Eval Grp	Washington.
IBM 650	Post Off	Operations	Boston.
IBM 650	do	do	Philadelphia.
IBM 650	do	do	Cincinnati.
IBM 650	do	do	Richmond.
IBM 650	do	do	Atlanta.
IBM 650	do	do	St. Louis.
IBM 650	do	do	Minneapolis.
IBM 650	do	do	Dallas.
IBM 650	RRB	Wage & Service Rcrds	Chicago.
IBM 650	Treasury	Internal Revenue Ser	Kansas City.
IBM 650	do	do	Lawrence, Mass.
IBM 650	do	do	Ogden, Utah.
IBM 650	VA	Management Services	Washington.
IBM 702	AEC	Hanford Works	Richland, Wash.
IBM 704	AF	AF Flight Test Cent	Edwards AFB, Calif.
IBM 704	AF	AF Spec Weapons Cent	Kirtland AFB, N. Mex.
IBM 704	AF	Air Proving Gnd Cent	Eglin AFB, Fla.
IBM 704	AEC	Albuquerque Oper Off	Los Alamos.
IBM 704	AEC	do	Do.
IBM 704	AEC	do	Do.
IBM 704	AEC	Argonne Laboratory	Chicago.
IBM 704	AEC	Bettis Power Lab	Pittsburgh.
IBM 704	AEC	General Electric Co	Cincinnati.
IBM 704	AEC	Knolls Laboratory	Schenectady.
IBM 704	AEC	Lawrence Rad Lab	San Francisco.
IBM 704	AEC	do	Do.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
International Business Machine Corp.—Con.			
IBM 704	AEC	Lawrence Rad Lab	San Francisco
IBM 704	AEC	do	Do.
IBM 704	AEC	Midw Univ Res Assn	Madison, Wis.
IBM 704	AEC	NY Operations Office	New York.
IBM 704	AEC	Sandia Base	Albuquerque.
IBM 704	AEC	Union Carbide Nuc Co	Oak Ridge.
IBM 704	Army	Ballistic Missile Ag	Huntsville, Ala.
IBM 704	do	do	Do.
IBM 704	do	White Sands Miss Rge	White Sands, N. Mex.
IBM 704	do	do	Do.
IBM 704	Commerce	Nat Bur Standards	Washington.
IBM 704	FAA	Flight Standards	Do.
IBM 704	NASA	Goddard Space Flt Ct	Do.
IBM 704	NASA	do	Do.
IBM 704	NASA	Langley Research Ct	Newport News.
IBM 704	NASA	Lewis Research Cent	Cleveland.
IBM 704	Navy	David Taylor Mod Bas	Washington.
IBM 704	do	Naval Ord Test Sta	China Lake, Calif.
IBM 704	do	Naval Ordnance Lab	White Oak, Md.
IBM 704	TVA	Tenn Valley Auth	Chattanooga.
IBM 705	AF	Air Weather Service	Asheville, N.C.
IBM 705	AF	Hq Air Defense Cmd	Colorado Springs, Colo.
IBM 705	AF	Hq Air Materiel Cmd	Wright-Patterson AFB, Ohio.
IBM 705	AF	Hq USAF Computer Cen	Washington.
IBM 705	AF	Memphis AF Depot	Memphis.
IBM 705	AF	Middletown AMA	Olmsted AFB, Pa.
IBM 705	AF	Mobile AMA	Mobile, Ala.
IBM 705	AF	do	Do.
IBM 705	AF	Ogden AMA	Ogden, Utah.
IBM 705	AF	Oklahoma City AMA	Oklahoma City.
IBM 705	AF	do	Do.
IBM 705	AF	San Antonio AMA	San Antonio.
IBM 705	AF	do	Do.
IBM 705	AF	San Bernardino AMA	San Bernardino, Calif.
IBM 705	AF	do	Do.
IBM 705	AEC	Sandia Base	Albuquerque.
IBM 705	Agriculture	Comm Stab Service	New Orleans.
IBM 705	Army	Ballistic Missile Ag	Huntsville, Ala.
IBM 705	do	Data Proc Br TAGO	Washington.
IBM 705	do	Eng Maintenance Cent	Columbus.
IBM 705	do	Signal Supply Agency	Philadelphia.
IBM 705	do	Transp Materiel Cmd	St. Louis.
IBM 705	HEW	Social Security Adm	Baltimore.
IBM 705	HEW	do	Do.
IBM 705	HEW	do	Do.
IBM 705	Navy	Aviation Supply Off	Philadelphia.
IBM 705	do	do	Do.
IBM 705	do	BuPers Hq	Washington.
IBM 705	do	Constr Battal Center	Port Hueneme, Calif.
IBM 705	do	Naval Shipyard	Vallejo, Calif.
IBM 705	do	Ships Parts Cont Cen	Mechanicsburg, Pa.
IBM 705	OSD	Armed Fes Sup Spt Ag	Washington.
IBM 705	Treasury	Treasurer U.S	Do.
IBM 705	VA	Insurance	Philadelphia.
IBM 705	VA	Veterans Benefits	Chicago.
IBM 7070	AF	Charleston AFB	Charleston, S.C.
IBM 7070	Army	Overseas Supp Agency	Brooklyn.
IBM 709	AEC	Hanford Works	Richland, Wash.
IBM 709	AEC	Lawrence Rad Lab	San Francisco.
IBM 709	Army	Ballistic Missile Ag	Huntsville, Ala.
IBM 709	do	Electronic Prov Grnd	Fort Huachuca, Ariz.
IBM 709	FAA	Research and Devel	Atlantic City.
IBM 709	NASA	Goddard Space Flt Ct	Washington.
IBM 709	Navy	Naval Missile Facil	Point Arguello, Calif.
IBM 709	do	Naval Ord Test Sta	China Lake, Calif.
IBM 709	do	Pacific Missile Rge	Point Mugu, Calif.
IBM 7090	Commerce	Weather	Washington.
IBM 7090	Army	Ballistic Missile Ag	Huntsville, Ala.
IBM 7090	NASA	Goddard Space Flt Ct	Washington.
IBM 7090	AEC	Lawrence Radiation Lab	San Francisco.
Special machines:			
LARC [1]	AEC	do	Do.
Maniac [1]	AEC	Albuquerque Oper Off	Los Alamos.
Do. [1]	AEC	NY Operations Office	New York.
MC 500 [1]	Commerce	Nat Bur Standards	Washington.
NAREC [1]	Navy	Navy Research Lab ONR	Do.

[1] Specially constructed to Government specifications.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
National Cash Register Co.:			
NCR 102	AF	School of Avia Med	Brooks AFB, Tex.
NCR 126	AF	do	Do.
NCR 1020	Army	Frankford Arsenal	Philadelphia.
NCR 107	Navy	BuWeps Hq	Washington.
NCR 304	do	BuDocks Hq	Do.
NCR 304	do	Mar Corps Base	Camp Lejeune, NC.
NCR 304	do	do	Camp Pendleton, Calif.
NCR 304	do	Mar Corps Hq	Washington.
Special machines:			
NORC [1]	do	Naval Weapons Lab	Dahlgren, Va.
Oracle [1]	AEC	Union Carbide Nuc Co	Oak Ridge.
Ordvac [1]	Army	Aberdeen Proving Grd	Aberdeen, Md.
Pilot [1]	Commerce	Nat Bur Standards	Washington.
Raydac [1]	Navy	Pacific Missile Rge	Point Mugu, Calif.
Radio Corp. of America:			
RCA 501	AF	Air Res Records Cent	Denver, Colo.
RCA 501	AF	Hq Airways Air Comm	Scott AFB, Ill.
RCA 501	Army	Ord Weapons Command	Rock Island, Ill.
RCA 501	do	Watertown Arsenal	Watertown, Mass.
RCA 501	CIA	Central Intel Agency	Washington.
RCA 501	Navy	BuWeps Hq	Do.
North American Aviation Corp.:			
RECOMPII	Army	Combat Dev & Ex Cent	Fort Ord, Calif.
RECOMPII	do	Electronic Prov Grnd	Fort Huachuca, Ariz.
RECOMPII	do	do	Do.
Special machines:			
SEAC [1]	Commerce	Nat Bur Standards	Washington.
Special [1]	AF	Aero Chart Info Cent	St. Louis.
Do. [1]	AF	Wright Air Dev Div	Wright-Patterson AFB, Ohio.
Stretch [1]	AEC	Albuquerque Oper Off	Los Alamos.
Transac [1]	AEC	Bettis Power Lab	Pittsburgh.
Do. [1]	AEC	Knolls Laboratory	Schenectady.
Sperry Rand Corp.:			
UFC 1	AF	1100 Support Group	Bolling AFB, Washington, D.C.
UFC 1	AF	Rome AMA	Rome, N.Y.
UFC 1	AF	Sacramento AMA	Sacramento, Calif.
UFC 1	AF	Warner Robins AMA	Robins AFB, Ga.
UFC 1	Army	Army Chemical Center	Edgewood, Md.
UFC 1	do	Frankford Arsenal	Philadelphia.
UFC 1	do	Ft George G. Meade	Fort George G. Meade, Md.
UFC 1	do	Mil Traf Man Agency	Washington.
UFC 1	do	Mobile Eng District	Mobile.
UFC 1	FAA	Air Traffic Mgt	Washington and field.
UFC 1	FAA	do	Do.
UFC 1	FAA	do	Do.
UFC 1	FAA	do	Do.
UFC 1	FAA	do	Do.
UFC 1	Navy	Mar Corps Supply Act	Philadelphia.
UFC 1	do	Mar Corps Supply Cen	Albany.
UFC 1	do	do	Barstow, Calif.
UFC 1	do	Naval Shipyard	San Francisco.
UFC 1	Post Office	Operations	New York.
UFC 1	do	do	Chicago.
UN 1103A	Army	White Sands Miss Rge	White Sands, N. Mex.
Sperry Rand Corp.:			
UNI I	AF	Air University	Montgomery, Ala.
UNI I	AF	Dayton AF Depot	Dayton.
UNI I	AF	Hq Air Materiel Cmd	Wright-Patterson AFB, Ohio.
UNI I	AEC	NY Operations Office	New York.
UNI I	Commerce	Census	Suitland, Md.
UNI I	do	do	Do.
UNI I	Navy	David Taylor Mod Bas	Washington.
UNI I	do	do	Do.
UNI II	Agri	Comm Stab Service	Kansas City.
UNI II	Navy	Electronics Supp Off	Great Lakes, Ill.
UNI II	do	Naval Shipyard	Philadelphia.
UNI 1103	AF	AF Missile Dev Cent	Holloman AFB, N. Mex.
UNI 1103	AF	do	Do.
UNI 1103	AF	Air Proving Gnd Cent	Eglin AFB, Fla.
UNI 1103	AF	do	Do.

[1] Specially constructed to Government specifications.

APPENDIX A

List of electronic computers in the Federal Government, by make and model (fiscal year 1960)—Continued

Computer	Department	Bureau, office, or command	Location
Sperry Rand Corp.—Con.			
UNI 1103	AF	Wright Air Dev Div	Wright-Patterson AFB, Ohio.
UNI 1103	AF	do	Do.
UNI 1103	NASA	Lewis Research Cent	Cleveland.
UNI 1103	Navy	Applied Physic Lab	Silver Spring, Md.
UNI 1105	AF	Dayton AF Depot	Dayton.
UNI 1105	AF	Rome AMA	Rome, N.Y.
UNI 1105	AF	Sacramento AMA	Sacramento, Calif.
UNI 1105	AF	Warner Robins AMA	Robins AFB, Ga.
UNI 1105	Commerce	Census	Chapel Hill, N.C.
UNI 1105	do	do	Chicago.
UNI 1105	do	do	Suitland, Md.
UNI 1105	do	do	Do.
UNI 120	AEC	Mason & Hanger, Inc	Burlington, Iowa.
UNI 120	Interior	Mines	Pittsburgh.
UNI 120	do	Reclamation	Ephrata, Wash.
UNI 120	SBA	Small Bus Admn	Washington.
UNI 90	AF	Armed Svs Tec Inf Ag	Arlington, Va.
UNI 90	AEC	Mason & Hanger, Inc	Burlington, Iowa.
UNI 90	Army	Fort Detrick	Fort Detrick, Md.
Underwood Corp.:			
UND 120	AF	Rome Air Dev Center	Griffiss AFB, N.Y.
UND 120	Army	Rocket Missile Agcy	Huntsville, Ala.
UND 120	TVA	Tenn Valley Auth	Chattanooga.
UND 120	TVA	do	Do.
UND 120A	AEC	Sandia Base	San Francisco.

APPENDIX B

COMMENTS OF THE CIVIL SERVICE COMMISSION ON "REPORT OF SURVEY OF PERSONNEL PROBLEMS OF THE UNITED STATES GOVERNMENT IN THE ADOPTION AND USE OF AUTOMATIC DATA PROCESSING SYSTEMS"

INTRODUCTION

PURPOSE OF THIS REPORT

This report has been prepared in response to the Bureau of the Budget's request for the comments and views of the Civil Service Commission on the "Report of Survey of Personnel Problems of the U.S. Government in the Adoption and Use of Automatic Data Processing Systems." The survey report (referred to herein as the Knight report) was prepared for the Bureau of the Budget by Lester B. Knight and Associates, Inc.

THE COMMISSION'S COMMENTS

The Knight report's numerous conclusions and recommendations generally fall into three categories:

1. Conclusions and recommendations which are a primary concern of or require direct action by Federal agency users and potential users of automatic data-processing (ADP) equipment.
2. Conclusions and recommendations which are a primary concern of or require action by the Civil Service Commission.
3. Conclusions and recommendations which require cooperative action by user and central staff agencies.

The Commission's comments generally are restricted to matters under categories 2 and 3. They cover the following topics:

I. Recruiting.
II. Testing and selection.
III. Position classification and pay.
IV. Turnover.
V. Manpower planning and statistics.
VI. Training.
VII. Central agency leadership.

For each of these topics, the Commission's comments follow a restatement of the pertinent conclusion or recommendation in the Knight report.

IN GENERAL

The Commission believes that the Knight report provides a useful tool for identifying, analyzing, and evaluating the personnel problems arising out of automatic data processing. We shall find this report useful in planning and conducting our further activities in this area, and we are sure it will prove useful to all agencies involved in ADP.

Maximum effectiveness in dealing with the personnel problems resulting from ADP will require informed and concerted action by the executive branch, the Congress, and employee and professional organizations. In many cases, this action is already underway. As indicated in our comments on the Knight report, recent legislative and administrative actions in a number of areas have strengthened and made more attractive the career civil service, and have met, in part at least, personnel problems growing out of ADP.

We did feel it was necessary to record exceptions which we must take to some of the conclusions and recommendations of the report. We found that the language used in presenting many of the conclusions and recommendations implies problems of far greater dimensions and seriousness than are substantiated by the data. In fact, in many cases the data demonstrate that the Government's problems are not nearly as serious as had been supposed: for example, in the proportion of

unfilled ADP positions; in the matter of the rate of loss of personnel to industry; and in the availability of trainable people within Government. We also feel that in expressing the dimensions of the training problem, the report does not take into account the tremendous reservoir for providing both formal and on-the-job training which is developing in the thousands of employees already trained and skilled in ADP. While we recognize serious training problems in certain selected areas, we feel that, in total, the training problem is overstated in the report. Each of these items is discussed more fully in the body of the report.

In taking these exceptions, we are not taking exceptions to the basic data revealed in the report. Rather, we are taking exception to conclusions which, we believe, are not appropriately drawn from the data. Also, the data in the report (nearly 1½ years old, now) focus attention on problems which existed in the past, particularly in the area of selection practices, but do not reflect the progress made in developing solutions to many of these problems.

I. Recruiting

A. KNIGHT REPORT

"Unless extraordinary measures not now known to be contemplated are taken, the Federal Government:

"1. Will continue to be outbid on the labor market and will get little of the top competence emerging from the educational system; and

"2. Will find it progressively more difficult to recruit the native competence [for ADP] from within" (p. 11).

Commission comment

The contention that the Government will be outbid for "the top competence emerging from the educational system" does not seem to be supported by the data in the Knight report. For example, the report states in substance:

1. The spread in entry level pay between business and Government appears to be less than sometimes supposed; and

2. The data indicate recruitment lag to be less serious than was thought * * * the greatest spread between filled and authorized is in the case of programers where there are slightly over 2,000 positions authorized and approximately 1,800 filled. The shortfall here is less than 10 percent. In the case of the other ADP occupations, the difference is only a matter of 2 or 3 percent.

In the light of these findings and the means which already exist to deal with recruiting problems for shortage category personnel, it is questionable that the recommended "extraordinary measures" are necessary. Two authorizations designed to assist the Government to recruit a fair share of top-level college graduates for entry level positions deserve special mention. These are:

1. The authorization in the Salary Increase Act of 1958 permits the hiring of college graduates with a degree but no qualifying experience at a higher pay rate than before, provided the graduate has an outstanding college record. The Commission has found this authority to be an effective means for attracting a fair share of the best college graduates to the Federal service.

2. Section 803 of the Classification Act permits payment above normal minimum rates in occupations where such rates are necessary to put the Government in a favorable competitive position to obtain its share of qualified people available. This authority has been used carefully but effectively in recruiting many scarce categories (e.g., scientists and engineers).

At the entrance levels, the Government's ability to pay higher rates has improved its recruiting position. At the higher levels, the increased rates have helped the Government to retain employees. It is significant that, with one minor exception (ADP equipment operators in Sacramento, Calif.), agencies have not found it necessary to ask the Commission to use this authority for ADP positions.

The Knight report conclusion concerning anticipated difficulties of recruiting from within needs to be reviewed in light of current knowledge about the requirements for ADP positions. On the basis of experience to date, it seems clear that the intelligence and aptitude needed to learn and perform ADP work are widely available in the Federal employee population. As the Knight report points out, most ADP positions currently are being filled by employees already on the rolls.

In most Federal agencies large enough to support an ADP installation, it should continue to be entirely possible to find persons with the ability to acquire specialized ADP skills. Evidence of the availability of such persons within

Federal agencies is the virtual nonuse of the Commission's register for electronic computer operator (trainee). Because of this nonuse, the Commission has closed the examination announcement.

With an increase in the intake of college-trained personnel as a result of current and planned intensive recruiting and examining activities, and with training possible under the new Training Act, additional persons with the requisiite aptitude for ADP work should be available to meet future needs.

B. KNIGHT REPORT

"Field establishments find difficulty recruiting young people not only because of lower entry level pay but also because 'They don't want to get involved with the Government.' Therefore an extensive and authoritative review is recommended of all Federal personnel policies and practices conceivably contributing to this attitude to see if they cannot be modernized and liberalized. This review should cover the Government's recruitment literature and personnel publicity." (A1)

"A continuous public relations and institutional relations campaign needs to be undertaken, under the leadership of a central agency, to increase intake of highly competent people." (C10)

Commission comment [1]

The Commission is acutely aware that to compete effectively for well qualified people, the Government has to make Federal careers attractive and to tell the public about them. With these objectives in mind, the Commission (1) reviews Federal personnel policies and practices, (2) provides leadership in the Federal personnel management field to stimulate the development of improved policies and practices, and (3) takes specific action aimed at increasing the Government's ability to attract and retain personnel.

The Government's ability to attract talented personnel is a matter of crucial importance when the present supply of people is short for many specialized jobs and when long-range projections of specialized manpower resources frequently are pessimistic. Changes and improvements in Federal recruitment and information programs will be required from time to time to keep pace with the increasing need for talented new employees.

During the past several years, significant progress has been made in the improvement of (1) personnel practices and benefits, (2) public information programs, and (3) recruiting programs. Some of the major improvements in these three areas are discussed below.

1. *Improving personnel practices and benefits.*—Some recent examples of progress that has been made in improving personnel practices and career benefits are:

(*a*) *A better appointment system.*—A new appointment system was developed under which employees start with career-conditional appointments and *progress to full career appointments. This gives the Federal employment* system flexibility to meet fluctuations in the size of the work force needed by the Government and affords greater protection to long-term employees.

(*b*) *Promotions on merit.—A new system of promotion on merit has been* inaugurated in the competitive service by the Commission to assure that promotions are made from among the best qualified employees. This system *offers employees clear-cut opportunities for advancement based on merit.*

(*c*) *Training.*—For the first time, Government-wide authority now exists for training Federal employees at non-Government as well as Government facilities outside the employing agency (Government Employees Training Act—Public Law 85-507). This is resulting in training programs that are more attractive to applicants.

(*d*) *Payment of traveling and moving expenses.*—Recent legislation (Public Law 85-749) permits agencies to pay the traveling and moving expenses of a *new employee and his family to his first place of duty provided he is hired for* a shortage category position and his skills are related to national security needs.

While these improvements have strengthened the recruiting position of the Federal Government, the Commission will continue to be alert to other actions that might be necessary to keep the attractiveness of Federal civil service careers within reasonable sight of careers offered in industry. For example, we recognize that there have been, and continue to be, problems with respect to the Federal

[1] These comments are based, for the most part, on the Commission's April 1959 report to the Subcommittee on Civil Service, House Committee on Post Office and Civil Service, "How People Are Recruited, Examined, and Appointed in the Competitive Civil Service."

salary structure which affect the attractiveness of Federal employment. The President has proposed to Congress that a comprehensive study be made of the Federal salary structure in order to resolve these problems on the basis of full information and a correlated plan. The salary discrepancies revealed by the Knight report, which are not peculiar to ADP, are not so serious as to justify shortcutting the President's proposal of an orderly approach to the whole area of pay.

2. *Improving public information programs.*—As suggested in the Knight report, not only must the Government's personnel policies be adequate, but the public must be informed about the significant advantages of Federal employment. The Commission's public information and public relations activities have been aimed for some years at enhancing the prestige of the public service through a continuing long-range educational program Governmentwide in content. The Commission also periodically reviews current assumptions about public opinion of the Federal service for the purpose of improving the program and changing its emphasis or direction.

In telling the story of employment opportunities in the Federal civil service, the Commission directs its informational efforts not only at the general public, but also at specific sources of recruits, such as high schools, technical schools, colleges, professional organizations, and trades groups. These informational efforts have three goals, all of which contribute to attracting high-quality applicants to civil service examinations:

(*a*) *High public regard.*—To build and maintain a high public regard for the Federal career service based upon knowledge of the scope, importance, and challenge of Government work.

(*b*) *Widespread knowledge of career opportunities.*—To give the public an appreciation of the Government as an employer offering opportunities in almost every occupational field.

(*c*) *Motivation of applicants.*—To motivate qualified people to apply for civil service examinations and accept Federal employment.

In undertaking these informational efforts, the Commission uses, to the limit of its resources, all forms of mass communication such as newspapers, radio, TV, magazines, and motion pictures. The central office, the Commission's 11 regional offices, and many boards of U.S. civil service examiners carry on general public information and public relations programs involving the use of some or all of these forms of communication. In addition, public information programe are carried on aimed at specific groups.

An example of a program directed toward a special group is the promotion of the Federal service entrance examination (FSEE). The purpose of this examination is to attract able college-caliber people into the service. These persons provide a reservoir of employees who have the potential ability to advance to higher management levels. The publicity connected with the examination is directed heavily toward the college campus. Experience with the FSEE thus far indicates that it is producing the quantity and quality of persons needed for important Government programs. As one sign of the success of the MSEE, 176 appointments to ADP positions were made nationwide at grades GS–5 and –7 from the time the series was established in the spring of 1958 through June 30, 1959.

3. *Improving recruiting programs.*—In addition to the activities already described, the Commission has taken additional actions to increase the effectiveness of Government recruiting programs and to induce highly-qualified people to seek and accept Federal employment. For example:

(*a*) The Commission has established recruiting representative positions in each of its regional offices and a director of recruitment position in the central office. Each recruiting specialist exercises the leadership needed to improve relations with sources of applicants, especially colleges, universities, and specialized organizations. Each specialist also cooperates with Federal agencies in planning, promoting, and conducting recruiting campaigns. The director of recruitment, through his contacts with many national headquarters, works on long-range, broad-gage programs involving review, evaluation, and coordination of nationwide activities initiated in Washington.

(*b*) The Commission has begun work on a group of projects with the following objectives designed to improve Government recruiting further:

To define the problems involved in attracting a greater number of well-qualified applicants.

To stimulate agency interest in the use of effective recruiting techniques to attract well-qualified applicants.

To promote better understanding and cooperation between Government recruiters and sources of recruits. One device for this purpose is a series of conferences between agency and college placement officials.

To promote greater understanding by high school and college students of the work of the Government and the people carrying on that work, thereby enhancing the prestige of the Federal career service. One publication issued for this purpose is the Commission's "Federal Careers—A Directory for College Students." This directory has been developed to meet the needs of college officials and students for specific information on Federal careers.

(*c*) The Commission has promoted a program of faculty visits to Federal agencies. The Commission believes that if faculty members know more about the important work done in Government agencies, they will be instrumental in referring able students for Government employment. In reply to a question posed by the Commission, the Comptroller General ruled that agencies can pay the travel expenses of faculty members who are invited to visit their installations for this purpose. A number of Federal agencies now have programs under which, for little more than the cost of transportation, they are able to show faculty members their operations and acquaint them with the important work of the Government. After such visits, faculty members are in a better position to advise students concerning Government employment.

In short, consistent with the Knight report recommendation, the Commission has emphasized activities designed to induce highly qualified people to seek and accept Federal appointments and has exerted leadership to keep the Federal personnel, recruitment, information, and other programs adjusted to the changing needs of the service.

We recognize, however, that additional efforts are needed to assure that the Government can compete on an equal footing with private employers for the Nation's talented personnel. Among other things, the Commission believes that additional efforts should include:

Installation of a continuing training program to improve the professional competence of Government recruiters.

Evaluation of the success of Government recruiting programs in order to determine for example, (*a*) whether we are attracting a fair share of high caliber college graduates, (*b*) if not, why not, and (*c*) whether the measures used to select top-quality people are valid in terms of success on the job.

Provision for more accurate long- and short-range forecasts of agency personnel needs by occupational category in order to assure better direction of recruiting programs and a closer relationship between examining programs and agency personnel needs.

Further development, under direction of the Commission, of a Government-wide college and high school relations program to combat the negative or indifferent attitudes of these sources of recruits toward Government employment.

Designation, at a high level within each agency, of a person to be responsible for coordinating and evaluating the agency's total recruiting program.

We have known for some time the direction that these and other additional recruiting efforts should take and we are making these additional efforts within the limits of the Commission's resources. However, we have been and continue to be unable to augment our resources to a point which would permit us to give recruiting programs all the additional emphasis which is needed.

II. Testing and Selection

A. Knight Report

"Experiment at a central point to develop techniques for assaying intelligence, personal traits, and aptitudes needed for ADP occupations" (All c and d).

Commission comment

The Commission agrees that further research is necessary and should be conducted wherever practicable. However, because of the wide geographical distribution of computer installations, the small number of employees usually involved in the typical installation, differences in and rapid changes of equipment, and the difficulty of developing stablized measures of satisfactory performance, we do not believe it is feasible to conduct this research at a central point. However,

further research would be desirable, and the Commission could well play a role in the coordination of the research efforts of different organizations.

As a result of research already completed, the Commission has been able to identify the range of aptitude and intelligence measures suitable for ADP occupations. These devices have been made available in qualification standards issued to Federal agencies. On the basis of additional research and experience, the Commission is providing agencies with revised and improved ADP qualification standards and aptitude and intelligence measures.

We recognize the importance of assessing temperament and personal characteristics needed for ADP work (as well as for other work), in addition to intelligence and aptitude. The Commission's staff, for example, has consulted with outstanding university and industrial psychologists on this problem only to confirm that there is a serious and general lack of sound measurement techniques for use on a mass basis in this area. While Commission resources have not permitted us to make a major research effort in this field, to date, the Commission's staff intends to explore the possibility of developing guidelines for measuring temperament and personal characteristics needed for successful ADP work as fruitful leads develop, and as manpower becomes available. In addition, the staff will keep in touch with the research in this field conducted by universities and other organizations and will make the results of this research available to Federal agencies where it seems pertinent to the Government's programs.

B. KNIGHT REPORT

"Standardize, on the basis of the best approach developed to date, interview records, rating methods, and written tests and continue to experiment on these and related techniques" (C 1 and 2).

Commission comment

The Commission agrees that it would be useful at some future time to standardize ADP selection and testing methods on the basis of the best approaches then available. However, as the Knight report points out, there currently is a wide variery of combinations of ADP jobs. Also, these jobs are relatively new and in many cases are not well defined. Therefore, the Commission believes that it is not time for complete standardization on the basis of one selection program for ADP jobs.

In its report to Lester B. Knight and Associates (app. item No. 4—Knight report), the Commission said that each agency has individual requirements for ADP operators and programers, within the broad framework of the Commission's standards. The best information we have to date, rather than the best single approach, is provided in that appendix. This same information was made available to agencies and, revised and improved, is being reissued. The Commission feels that additional research and additional experience with selection methods for ADP positions are needed before the best approaches can be identified and made generally applicable. In the meantime we have given agencies guidance which has carried them beyond the trial and error stage.

C. KNIGHT REPORT

"Necessary action should be taken to provide adequate assistance to individual installations to bring their ADP selection practices up to optimun" (C3).

Commission comment

The Commission regularly furnishes its regional offices with information needed to assist local installations to solve ADP and other selection problems. Regional offices of the Commission provide a continuing advisory service on selection problems for local installations. For example, we recently supplied both job candidates and testing devices to two new ADP installations. One was installed by the Bureau of Public Debt, Parkersburg, W. Va., and the other by the Naval Finance Center, Cleveland, Ohio.

In addition, the Commission's central office has assisted installations to solve specific problems in light of local needs. We agree that continuous effort is desirable to meet local installation needs and to make sure that available information is disseminated as widely as possible. We believe that the Commission, to date, probably has given ADP jobs more attention than any other occupation, in terms of the number of persons employed in the ADP field. The Commission will continue to provide this type of service to the fullest possible extent.

D. KNIGHT REPORT

"Reconsider ADP selection standards in view of findings on manpower requirements. Such standards should not be waived on grounds of expediency" (C4).

Commission comment

We agree that it is desirable to establish selection standards for ADP jobs in light of manpower requirements and that such standards, once properly set, should not be readily waived for expediency. The ADP standards which the Commission has issued provide agencies with considerable flexibility in evaluating the ability and competence of applicants for ADP positions. At the same time, however, these standards set minimum qualifications designed to insure that persons selected are capable of performing the work. The standards are not subject to change or waiver by local installations without justification and approval by the appropriate Commission office. As we already have indicated, the Commission will continue to appraise the adequacy of these standards to insure that they are meeting agency needs and are keeping pace with developments in the ADP field.

III. Position Classification and Pay

A. KNIGHT REPORT

"The job grading process, which is generally oriented if not by conscious policy at the center at least by the sum of actions at the periphery, to keeping down the Government wage bill and the great mass of employees happy by keeping all occupations more or less 'in line' salarywise, should not be allowed to stifle new professions. That some ADP 'administrator' jobs are graded vulnerably low is attested to by the fact that there was only 1 job reported above grade 15 and the median grade is 13" (A3).

Commission comment

Contrary to the conclusion of the Knight report, the Governments' job-grading policy is not an unconscious result of a "sum of actions at the periphery." It is a policy deliberately legislated by the Congress to provide for equitable treatment of all occupations covered by the Classification Act on the basis of difficulty and responsibility of work, and in accordance with statutory definitions of the level of difficulty and responsibility to be allocated to each grade.

The Commission does not find any basis, either in the Knight report, or in its dealings with agencies, for concluding that the "job grading process" [i.e., position classification] is stifling ADP occupations. A circularization of using agencies after a year's experience in the use of the standards [and 10 months after collection of the Knight report data] brought no complaint about grade levels being too low.

To the extent that salaries for ADP positions in grades GS–13 and higher are out of line with industry salaries, it should be noted that this is a general condition for all positions at these levels under the Classification Act and is not peculiar to ADP positions.

B. KNIGHT REPORT

"It is recommended that there be developed a wage-board approach to setting salaries for ADP positions. This approach would recognize that a new and discrete field of this kind is a universe unto itself which should not be subjected to the rigidity of the grade system and for which pay should be based on a national market rate" (A7).

Commission comment

The Commission does not concur in the recommendation to establish a separate pay category for ADP occupations. We recognize that statutory salary rates of the Classification Act often cannot be changed on a timely basis to assure reasonable comparability with salaries in private employment. However, this is a general deficiency of the classification pay system which affects not only ADP occupations but many other equally important occupational areas.

Adoption of a separate pay category for ADP occupations would add to difficulties which exist today because of the existence of numerous Federal pay systems and would result in new difficulties and inequities. For example, the Knight report describes a pattern which reflects a sharing of duties among ADP personnel and scientists, engineers, and mathematicians. According to the report, ADP programing frequently is done by scientists and engineers who prefer to remain identified with their disciplines. When a full-time ADP programer is employed, he generally is expected to be qualified in the technical field involved. Because

of the close relationship which frequently exists among ADP and scientific and engineering occupations, it seems evident that different pay treatment for the two groups would be ill-advised. Treating a programer trained in physics under one pay system, for example, while treating a physicist who does his own ADP programing under another could create serious salary inequities and morale problems.

The Commission has consistently maintained that a solution to Federal pay problems lies not in preferential treatment for a particular occupational group. Rather, it has recommended that a comprehensive study of Federal pay problems and systems, covering all occupational groups, be undertaken by an appropriate group, such as the Joint Commission on Civilian Employee Compensation proposed by the President. Also, it should be emphasized that agencies have not asked the Commission to use the existing pay flexibility in section 803 of the Classification Act (except in the one minor case noted previously). This is some indication that the "shoe is not pinching" with respect to ADP pay rates. Agencies have not hesitated to ask for higher rates for scientific occupations but apparently have felt no need for higher ADP pay rates.

C. KNIGHT REPORT

"The relationships between the pay scales of management analyst (digital computer) and programer should be reviewed in light of the more definitive job engineering which needs to be developed to make sure that one is not overpriced in comparison to the other" (A8).

Commission comment

This recommendation seems based, in part, on the assumption (which also underlies the recommendation discussed under F, below) that the Commission should exercise a central control over organization of work within agencies. The Commission does not accept this assumption.

We recognize that there has been, and is, some confusion and overlapping of systems analysis and programer functions. The recent revision of standards, issued as part of the Commission's responsibility for keeping standards abreast of developments in ADP occupations, establishes digital computer systems analysis as a separate series, with a clearer basis for distinguishing programing work from systems analysis work. This should eliminate some of the confusion which now exists. However, these functions will undoubtedly continue to be mixed in many situations as a matter of local organization.

In any event, the data in the report indicate that the problem behind this recommendation is not one of occupational definition, nor one of adjusting relationships of pay scales. It is partly a problem of supervision and management, and partly a problem of proper interpretation, at local levels, of classification standards which the Commission has provided. In other words, the body of the report makes clear that the issue arises when systems analysts are being given grade credit for, but are not adequately doing, the systems analysis job, so that the programers have to do it after them. It is local management's responsibility to see that employees adequately perform the jobs to which they are assigned, and for which they are given grade credit. It is a responsibility of classification, at the local level, to ascertain where management has placed responsibility, and to give credit to it at that point. Classification standards call for classification, not on the basis of title, but on the basis of responsibilities actually assigned. Thus, if a programer actually has systems analysis responsibilities, he can be given grade credit for it.

D. KNIGHT REPORT

"Take more account of the differences in setting of ADP used for scientific purposes and that used in business-type applications in establishing job standards and qualifications for the several ADP occupations" (B1).

Commission comment

The information in the Knight report on this subject provides helpful data for considering whether there should be differences in classification and qualification standards for ADP positions involved in scientific and business-type data processing. The Commission's Standards Division plans to use the information in the Knight report to investigate and take appropriate action on this situation during the next regular review of ADP standards.

E. KNIGHT REPORT

"It is recommended that provision be made for frequent reappraisals of ADP job standards, allocations of individual positions, and pay scales" (B2).

Commission comment

The Commission agrees with this recommendation and will continue to review and adjust ADP standards as this new field develops and stabilizes. However, this review and revision will be independent of any adjustment in the pay scales for ADP positions. Pay adjustments, except those made under section 803 of the Classification Act, can result only from congressional action as part of a general adjustment in the Classification Act pay structure.

As a footnote to the subject of classification and pay, we feel that it is necessary to call attention to an apparently unrecognized skew built into the Knight report data on average grades which makes these averages abnormally low. Because the ADP population is a relatively young, i.e., new on-the-job population, including a very large percentage of trainees who are in jobs sometimes as much as four or five grades below the journeyman level for their occupations, the average grade figures shown in the Knight report (exhibit 1) are lower than the average which would apply, under existing classification standards, if the occupations were more mature. Thus, an increase in the average grade for these occupations is more likely to reflect maturing of the occupation than grade escalation. We would estimate this skew to be at least one grade, except in the case of peripheral equipment operators. In this case, the training time is short enough that we doubt that the skew is significant.

F. KNIGHT REPORT

"The Government should concentrate on the job of improving the job breakdown among the various ADP occupations to reduce the number of combinations and patterns of occupational specialization and to make sure there is a logical functional basis for each alternative finally determined upon" (B3).

Commission comment

Development of a logical classification structure for ADP and other Classification Act occupations clearly is an objective of the Commission's standards work. Existing ADP occupational standards we believe have contributed significantly to improving job breakdowns by providing agencies with a valuable tool for organizing ADP work logically.

While the Commission's standards frequently are an important factor in determining how work is organized, responsibility for the proper organization and accomplishment of work at each ADP installation rests finally with the head of the agency. The Commission believes that a central control over organization of work at individual installations, which this recommendation implies is needed, would be unfortunate. It could result in an inflexibility which would make it difficult if not impossible for the head of the agency to tailor jobs to fit each ADP installation's specific functions and needs.

IV. Turnover

A. KNIGHT REPORT

"Unless extraordinary measures not now known to be contemplated are taken, the balance of flow of experienced ADP people will be out of the Government rather than into it" (p. 11).

Commission comment

While the loss of even one skilled Federal employee cannot be dismissed too lightly, the need for the extraordinary measures called for by the Knight report does not seem demonstrated at this time.

The conclusion stated above is not supported by the data in the report or by expereience to date. On a nationwide basis, a turnover rate of nearly 20 percent a year was reported in ADP occupations. However, only about one-third of this loss was to industry, while intra-Government movement of ADP personnel (presumably movement to other ADP jobs) accounted for another one-third of the turnover rate. The remainder of the turnover apparently resulted from normal causes, e.g., not suited to ADP work, death, and retirement. It also should be noted that a 20-percent turnover rate in ADP occupations (1) is about the same as service-wide turnover rates (for example, during calendar year 1958,

the separation rate for Federal employees in the continental United States was 19.8 percent) and (2) is considerably less than industry rates.

B. KNIGHT REPORT

"Promotion policies and practices should be modified to achieve flexibility for a more rapid rate of promotion as a safeguard against civilian turnover" (D1).

Commission comment

We do not find a basis for concluding (1) that the present legal requirement for promotion (Whitten amendment to the Independent Office Appropriation Act, 5 U.S.C. 43) is causing turnover in ADP occupations or (2) that removing the requirement would ameliorate turnover problems. For one thing, the Knight report states that with respect to ADP turnover problems in private firms (which are not subject to a legal restriction on promotions) the picture was not unlike that to be seen in Government. Also, it is difficult to see how removal of the current promotion requirements would solve the problem of movement of ADP personnel to other Government installations when the additional flexibility would be available to all Government agencies and could result in bidding for employees.

The Commission believes that the flexibility in promotion policies and practices which the Knight report suggests is needed already is available to agencies through use of training agreements. Using this approach, the Commission can enter into special agreements with agencies whenever it is found advantageous to the Federal service for certain employees to be prepared for advancement to higher grade positions within a shorter period of time than is normally possible. Such agreements may provide for the acceptance of inservice training as a means of supplementing the trainee's qualifications in order to provide the full equivalent of training and experience required for promotion.

Training agreements have been successfully and widely used to accelerate the development of needed personnel in many occupational fields. To date, the Commission has approved training agreements for ADP occupations in more than 70 agencies and installations. The value of these agreements is reflected in the Knight report comment that the training agreement (was) most frequently cited of all devices that have been helpful in holding personnel.

C. KNIGHT REPORT

"As far as turnover is concerned, a major problem is the extent to which Government agencies compete with one another. Corrective action should include:

"Elimination whenever possible of disparities in pay and prerequisites that make this possible.

"Action in flagrant cases by the Civil Service Commission to forestall raiding" (D4a and c).

Commission comment

The Commission agrees that unwarranted pay disparities among ADP positions (i.e., differences in basic compensation which are not based on differences in duties, responsibilities, and qualification requirements of the work) should be eliminated. The Commission acted to achieve this objective when it issued position classification standards for ADP occupations. The Commission will continue to act on this matter as its limited resources permit through its regular inspection of agency position classification actions and improvement of the ADP occupational standards.

While agreeing that it is necessary to eliminate unwarranted pay disparities among ADP positions, the Commission does not find in the report evidence that existing differences are unwarranted or that they are as critical as the Knight report indicates. The report, for example, gives considerable weight to the finding that average grades for some ADP occupations are higher in the departmental service than in the field service. The report, however, does not offer any evidence that the differences in average grades are unwarranted or that they are, in fact causing turnover. Differences in average grades among related field and central office positions frequently are found within many technical and professional occupational fields. These differences commonly reflect differences in responsibility and difficulty of the work performed at headquarters offices and field installations.

The Knight report does not clearly establish the meaning of its reference to flagrant cases of raiding. If this means that some agencies are offering higher grades than other agencies for identical work, then preventive and corrective action is required. However, there is no evidence this is occurring.

On the other hand, if this recommendation means that the Commission should discourage employees from seeking and accepting more responsible work, either in their own agencies or in other agencies, then the Commission strongly disagrees with the recommendation's intent. The Commission believes that movement of personnel is frequently essential from the Government's standpoint and is valuable to employees. Generally, the Commission has encouraged such movement, particularly when it makes additional career opportunities available to employees and results in better use of employees' skills. While it is true that all such movement may not benefit the Government, we believe that a general restriction not only would be difficult to administer, but also would result in serious damage to employee morale and to the effectiveness of many Government programs.

V. Manpower Planning and Statistics

KNIGHT REPORT

"The measures needed to solve or merely ameliorate the automatic data processing manpower problem will never be undertaken unless much better mechanics for and much greater attention to long-range manpower planning become available at a point of governmentwide perspective" (p. 12).

"It is recommended that more complete statistics about Government employment and requirements for ADP manpower and salary rates for ADP be maintained carefully on a regular basis" (A2).

"Long-range planning for ADP manpower—i.e. in terms of 5 years and 10 years should be undertaken as a matter of even greater urgency than shorter range planning and it is equally essential that it be done on an annual basis" (A15).

Commission comment

Sound long-range manpower planning requires joint planning and action by operating agencies, the Bureau of the Budget, and the Commission. These joint efforts should involve, among other things:

1. Assessing agencies' current manpower situations;
2. Anticipating changes in agencies' programs affecting manpower;
3. Recruiting, training, and properly using employees with potential for growth and development; and
4. Anticipating fiscal requirements relating to long-range manpower and program needs.

The Commission believes that the Bureau of the Budget's Interagency Committee on ADP provides an appropriate and useful means for providing the required concerted action on Federal ADP manpower problems. The Commission supports the Knight report recommendation for the creation by the interagency committee on manpower and personnel.

In the personnel management field, the Commission has underway or has completed a number of programs and projects designed to improve the Government-wide manpower situation, in addition to those already mentioned (e.g., intensified recruiting efforts and the Federal service entrance examination). Although most of the programs are concerned with Federal manpower problems generally, rather than a single occupational group, they are also pertinent to the ADP manpower question.

1. *Statistical data.*—As a first step in planning to meet manpower requirements, accurate and current employment data are needed. For manpower planning and other purposes, the Commission regularly collects a wide variety of Federal employment statistical data. At the time of the Knight study, data on ADP employment and salary rates were not available (Knight report, recommendation A2). However, as the part of its next regular survey of "Occupations of Federal White-Collar Workers," to be conducted during October 1959, the Commission will obtain employment and salary data for persons in the ADP occupational field.

2. *Estimating long-range manpower requirements.*—As suggested in the Knight report, estimates of long-range manpower requirements are needed. The Commission has taken the first step toward forecasting Government-wide manpower requirements. On a pilot-study basis, the Commission asked 10 agencies to estimate, as of December 1958, their scientist, engineer, and certain other manpower requirements over a 1- and 5-year period. Results of this survey are now being evaluated. If the initial forecast based on the pilot study is considered

valid, a regular long-range forecast of manpower requirements may be included as part of the Commission's regular statistical reporting system. These forecasts could, of course, be extended to ADP occupations.

3. *Long-range staffing plans.*—The Commission's recruiting and examining programs have consistently been designed to assure a continuous supply of competent manpower. The stated objective of the Federal service entrance examination is not merely to fill annual manpower needs, but to bring into the Federal service highly qualified, career-minded people who have the potential to become managers, skilled technicians, and professional leaders of the future. During a 3½-year period approximately 20,000 appointments have been made as a result of the FSEE program. Persons who have entered the Government through the FSEE program, including those appointed to ADP positions, already have moved into responsible positions throughout the service.

In addition to providing a means for acquiring high-caliber personnel, the Commission has encouraged and assisted agencies to develop and fully use those persons who can cope with the technological and managerial problems of the future.

VI. Training

A. KNIGHT REPORT

"The most acute problems revealed by this study lie in the area of training. It is therefore recommended that responsibility for developing and activating an interagency ADP training program be definitely assigned to an appropriate central agency of the Government along with commensurate planning and coordinative authority" (E1f).

"The Government should support and make greater use of the training facilities of universities, consultants, and other nongovernmental training resources. For an optimum program of using outside resources, a central focal point within the Government should be established to lead in the planning and brokerage job involved" (E1,2,3).

Commission comment

At the outset, we emphasize that the Government Employees Training Act places basic responsibility for training Federal employees squarely on the heads of employing agencies. It is the responsibility of the head of each agency and his staff to develop or obtain the training needed to meet the needs of employees in his organization. If it is the intent of the first recommendation (E1f) to shift this responsibility to some central agency, we disagree with that intent. As we see it, the role of the central staff agency is to assist other agencies in carrying out their training responsibilities. This can be done by (*a*) advising and assisting agencies in the conduct of internal programs; (*b*) encouraging, coordinating, and assisting with interagency training activities wherever that practice seems to be the most efficient one; and, (*c*) encouraging use of additional training resources, if needed, outside of the Federal Government.

Quite clearly, therefore, action leading to the solution of the Government-wide training problems identified in the Knight report requires the active cooperation and participation of all Federal agencies concerned. Such action currently is underway.

Under the auspices of the Bureau of the Budget's Interagency Committee on Automatic Data Processing, an interagency task force has been established to develop policies and plans to meet the need for Government-wide ADP orientation and training programs. The task force is working under the direction of a senior member of the Commission's staff. Using the Knight report data on ADP training needs as a starting point, the task force will develop specific answers to such questions as:

1. Who needs training by job category and level?
2. Who will organize and conduct orientation and training sessions?
3. What are current and anticipated training requirements by type of course and level of trainee?
4. What kinds of training should be conducted on a Government-wide or interagency basis?
5. What nongovernmental facilities should be used?
6. What kinds of Government-wide coordination are required for a service-wide program of ADP training and orientation?

We understand that the report of the task force, recommending specific action on these and related matters, will be completed by November 1959. The Com-

mission believes that the findings and recommendations of the task force should provide a sound basis (1) for meeting ADP training needs and (2) for Government-wide coordination of ADP training programs.

In the meantime, the Commission has taken the following steps to meet governmentwide ADP training needs:

1. In the spring of 1959, the Commission conducted an ADP appreciation program for Federal agency executives, i.e., chiefs and assistant chiefs of bureaus and divisions and staff officials. This program was designed to give basic knowledge of ADP and its potential. The program was carried out with the assistance of ADP experts drawn from a number of Federal agencies. Because of the success of this first training program and the continued agency demand, a second program is planned for October 1959.

2. Federal agencies have been asked to inform the Commission of their ADP training courses which can accommodate employees of other agencies. The Commission periodically will publish this information as a means of fostering the fullest use possible of existing governmental training resources.

3. The Knight report states that ADP training resources of universities need to be used if the Government is to meet fully the reported ADP training requirements. The Government Employees Training Act assigns basic responsibilities for employee training to the head of each agency and authorizes agencies to send employees to nongovernmental training facilities when Government training facilities are not reasonably available. To assist Federal agencies to use outside ADP training facilities when necessary, the Commission's staff currently is working with the Office of Education to develop a catalog of schools which provide training in ADP and in advanced management techniques. The information will be maintained in the Commission's central and regional offices and will provide agencies with an easily accessible source of training assistance which they can use as needed.

We believe that the agencies have been meeting their training responsibilities with respect to ADP occupations and that the Commission has been responsive to their needs. However, we recognize that additional efforts may be required. The plans and programs to be developed by the Interagency Task Force on ADP Orientation and Training are expected to provide the basis for these additional efforts.

VII. Central Agency Leadership

A. KNIGHT REPORT

"It is recommended that the Federal Interagency Committee on ADP create a standing subcommittee which would keep abreast of developments relating to ADP manpower and personnel problems and report periodically to the full committee. Its terms of reference should cover the full range of personnel problems," (A–4).

Commission comment

The Commission endorses this recommendation and believes that the proposed subcommittee can make a significant contribution to the continuing identification and solution of ADP manpower and personnel problems. This group should be *particularly effective since its membership would consist of top-level agency per-*sonnel responsible for planning or administering major Federal ADP installations. The Commission's representatives on the Interagency Committee on ADP are available to assist the proposed subcommittee to the fullest extent.

In addition to the personnel problems which the Knight report recommends for consideration by the proposed subcommittee, the Commission suggests that the subcommittee:

1. Work out a program for developing case histories of ADP applications which would draw heavily on the experience of agencies represented on the Interagency Committee on ADP.

2. Identify specific personnel research problems which now are being neglected and which, in the view of the ADP experts, need immediate attention.

B. KNIGHT REPORT

"Central agencies and departmental levels of Government should take more initiative on ADP manpower problems and personnel practices to provide more coordination, better leadership, and in general to bring the amount of higher-level management attention paid to ADP personnel matters more in line with that paid to ADP equipment acquisition and details of ADP application," (A–10).

Commission comment

The Commission recognizes that the personnel problems resulting from the application of ADP must be successfully met if the Government is to realize the full potential of the new technology for greater production and improved services to the Nation. We also believe that the Commission, other central agencies, and agency users of ADP must demonstrate initiative and imagination in coping with these problems as they arise.

The Commission is concerned, however, that this recommendation and the Knight report generally fail to recognize action already taken and planned by the central agencies and agency users of ADP equipment. For this reason, we believe that it is important to summarize the actions already taken by the Commission to assist agencies to solve problems associated with the introduction of ADP into governmental operations. When the Commission's activities are considered with the actions and accomplishments of the Bureau of the Budget, General Accounting Office, and other Federal agencies, the result is an impressive picture of the Government's achievements in the ADP field. Specifically, beginning in 1953, the Civil Service Commission has:

Negotiated training agreements for ADP occupations with more than 70 agencies and installations. These agreements have represented a practical, effective means of meeting the shortage of skilled ADP personnel through careful selection and intensive training of persons capable of acquiring ADP skills. The worldwide agreement for civilian career fields in ADP in the Quartermaster Corps is a significant example of the successful use of training agreements.

Assisted field stations to staff ADP installations. One early example of this type of activity was the recruiting assistance given by the fifth U.S. civil service region to Gadsen Air Force Depot during 1955 in the recruitment of electronic equipment programers.

Conducted the first governmentwide review of the impact of ADP on personnel management. The results of this survey were published in the Commission's December 1957, pamphlet "Personnel Impact of Automation in the Federal Service."

Consulted with representatives of major Federal employee organizations on the personnel problems stemming from ADP (1956).

Initiated a study of ADP occupations (1955) which led to establishment of separate titles for ADP occupations (1957) and publication of new position *classification standards for ADP positions (1958). The standards have* helped agencies to conduct orderly position classification, recruitment, placement, and training activities in the ADP occupational field. The standards *have been reissued recently in revised and improved form.*

Developed and made available tests, rating schedules, and qualification standards for ADP positions (1958).

Prepared and presented at a governmentwide personnel executives' conference a case study on the conversion of a clerical operation to ADP (1956).

Conducted an ADP appreciation course for executives (1959).

Developed and installed several programs designed to meet servicewide personnel management needs, which also have contributed to the solution of some ADP personnel problems, *e.g.*, Federal service entrance examination (1955); the Federal merit promotion program (1959); and improved recruiting programs.

The Commission believes that these and similar actions and accomplishments to date, as well as its plans for future action, some of which are discussed in this report, (1) indicate early recognition of the personnel problems associated with ADP and (2) represent formal central agency leadership and recognition of responsibilities in the personnel field.

APPENDIX C

ADDRESS OF JOHN A. BECKETT, ASSISTANT DIRECTOR OF THE BUREAU OF THE BUDGET

Before the Symposium on Integrated and Automatic Data Processing Systems Federal Government Accountants Association, Statler Hilton Hotel, New York City, May 23, 1960

(To be published in a forthcoming issue of Federal Accountant)

A New Look at ADP Systems—Government-wide

Your program committee has asked me to speak to you about a new look at ADP systems in the Federal Government. That work "new" bothers me a bit. I do not quarrel with the use of the word, because in reality the way we look at ADP systems today—as opposed to a few short years ago—is new; but it is new only in the sense that it is different. And it is different because those who do the looking are for the most part wiser through experience.

THE DECADE OF DEVELOPMENT

In the environment of 1950, the very few people who knew the potential capabilities of the half-dozen or so computers then in existence had only one direction in which to look—that was straight ahead—and even to them the visibility was not wholly clear. By 1955 this situation had changed a little, but not enough to be meaningful to more than a select few. But in 1960, thanks to the pioneering efforts of several of our departments we now have available enough hindsight and the results of enough practical experience to make it possible for us to begin to assess the past in order that we can be more realistic in our plans for the future. This experience factor will become more and more meaningful as time goes on, of course, because, of the approximately 700 computers in use today in business management, science, and engineering in the Government, probably no more than 15 or 20 percent have been in operation long enough to provide the basis for a logical assessment of our success in exploiting their full potential. But even with this small percent it has been possible to formulate some useful guidelines and to identify numerous aspects of ADP utilization where guidance is lacking. In short, following what I would like to call the decade of development in data processing, we are at a logical point at which we should take careful inventory—a fresh and new look.

As with all pioneers, those in the vanguard of ADP utilization have seen some conceptual bubbles burst; the pioneers have also faltered at times; they fell into some traps because they didn't know where those traps were. But they kept pushing ahead in the sure knowledge that this was the price of progress.

To all of these people most favorable recognition is due. Instead of indicting them for what we might now call errors of judgment, we should and do commend them for discovering errors we now know we must avoid. And it is as a result of the efforts of these ADP pioneers in Government that we are able now to draft more realistic plans for the future—plans for action by the departments and agencies in their own behalf as well as by the central agencies for the Government at large.

For the past several years in the Bureau of the Budget, and for longer periods in a few of the departments, programs for insuring more practicable utilization of ADP equipment have been in the process of formulation. In terms of the governmentwide efforts in this direction, I would like to identify for you a few of the special projects or studies which have been completed, are now underway, or are planned for the future. As I do so you will note that the Interagency Committee on Automatic Data Processing is, and will continue to be, a major force in identifying and recommending courses of action for dealing with ADP problems of mutual concern and thus in helping to formulate guidelines which the Committee members can then apply to similar problems within their own establishments.

An important fact about the Committee is that a number of the people to whom I earlier referred as pioneers—some of whom might now be called elder statesmen in the ADP field—are active members of the Committee and thus rubbing shoulders frequently with other members whose knowledge and experience is of shorter duration.

Here are a few of the things which have already been accomplished:

1. In 1957 the Interagency Committee on Automatic Data Processing was established. It is composed of members and alternates from the 12 largest departments. Representatives from many other departments participate in its activities. This Committee is chaired by the Bureau of the Budget.

2. With the aid of the President's Management Improvement Fund, the Bureau of the Budget sponsored a study of the governmentwide ADP responsibilities of the central agencies. The findings of this study constitute the framework upon which the ADP program of the Government is being built.

3. A consulting firm was employed to study and report on the personnel problems involved in the use of ADP equipment. The findings resulting from this study have been quite useful in dealing with the ADP impact upon personnel administration in our agencies and governmentwide.

4. Since its inception, the Interagency Committee on ADP has appointed task forces to study and report on a number of ADP problems. Reports have already been received by the Bureau of the Budget from the Committee on such subjects as—

(*a*) Rental versus purchase of ADP equipment.
(*b*) Interagency sharing of equipment.
(*c*) Determining the costs of ADP applications.
(*d*) A governmentwide information exchange.
(*e*) Guidelines for studies to precede the acquisition of ADP equipment.
(*f*) A governmentwide program for ADP orientation and training.

As I shall point out presently, all of these reports have been or are being used as a basis for action.

5. With the help of the Committee report on "Determining Costs of ADP Applications," the Bureau of the Budget last October issued a call to all Government agencies for an inventory of ADP equipment, to be accompanied by indications of the uses being made of this equipment and the cost of its operation both in dollars and in people. These data have now been summarized and will soon be distributed throughout the Government.

6. The Committee report on "Guidelines for Studies To Precede the Acquisition of ADP Equipment" was transmitted in March of this year to all Government departments and agencies with the suggestion that the report be used as a guide when ADP studies of various types are being planned or conducted.

Now let me identify some of the things underway:

1. *Rental versus purchase.*—Picking up where the Interagency Committee on ADP left off, the Bureau of the Budget and the General Accounting Office are jointly engaged in a project for the development of policy and guidelines on whether it is more advantageous to the Government, in all or some cases, to rent or purchase ADP equipment. It is too early and too risky to forecast the outcome of this study, but I can and will say that there is a mounting body of evidence indicating that the practice of renting all ADP equipment as standard policy—a policy which seems to prevail in some quarters—may need to be modified in some degree.

2. *ADP orientation and training.*—With the aid of the Interagency Committee report on ADP orientation and training, which we received just 2 weeks ago, a governmentwide program will soon be formulated in this area. This program will of course take into account (*a*) the training work already accomplished by many of the departments, (*b*) the interagency ADP training courses and the ADP management intern program of the Civil Service Commission, as well as (*c*) the additional training and orientation needs we now recognize. This additional training I speak of includes the needs of many of the top-level officials of Government for a better comprehension of the capabilities and limitations of computers and the impact computers can have upon the organization and operation of their agencies, upon the people employed, and upon budgets. This training also includes recognition of the fact that a fair proportion of the people who perform the systems analysis aspects of computer utilization are in need of some additional training. I may say to you that in most other respects, as in the case of computer programers and operators, for example, there are indications that the departments and agencies have these training requirements well in hand and that no interagency governmentwide concentration of effort seems necessary.

3. *Computer service center.*—About a month ago we in the Bureau of the Budget started a study to determine whether or not the need to establish one or more computer service centers in the Government truly exists. If it appears that sufficient requirements exist to keep such a center (or centers) busy, then as a further objective of this project we will proceed with the help of appropriate agencies to draw up a set of definitive plans, specifications, and procedures as to how to organize, finance, staff, equip, and assign responsibility for the operation of an experimental service center. During this second phase we will deal also with such factors as service charges, economic feasibility and competition with private business. We expect to finish this project in November of this year.

4. *ADP Committee reorganization.*—In consultation with the members of the Interagency Committee on ADP, we in the Bureau of the Budget are currently studying possibilities for assuring that the Committee will continue to improve its effectiveness as (*a*) a medium for the interchange of ideas and information, (*b*) a forum for the discussion of mutual problems, (*c*) a proponent of new or revised Government-wide guidelines for ADP operations, and (*d*) an advisory body to the Bureau of the Budget and others on the form and shape of things to come in the ADP program of the Government. A subcommittee has prepared and submitted recommendations for the organization and future role and program of the full Committee. These recommendations are now under consideration.

5. *Sharing ADP equipment within and between departments.*—The intraagency sharing of ADP equipment time seems to be gaining momentum in some of the agencies where top leadership has recognized the operating and economic advantages of this practice. Equipment sharing has its problems as well as its benefits, as the Committee task force report which I referred to earlier appropriately points out. But a determined leadership will bring about desirable equipment sharing in any agency—not sharing solely for the sake of sharing.

The data we obtained recently on interagency sharing of ADP equipment—and similar data we plan to obtain from year to year—will serve to aid us in fostering and promoting a practicable degree of interagency sharing of ADP equipment.

6. Integrated data processing—which we all know as IDP—is, I note with enthusiasm, a significant part of the deliberations of this symposium. Integrating data for the use of supervisors and executives has always been a challenge, at least to the few who have worked at it. But today it is a challenge to all who are engaged in data processing, particularly to a group like yours which is primarily interested in financial management data. We once had some rather valid excuses for not integrating data of several types, but in today's environment none of those excuses are legitimate. Certainly we now have the hardware to do it with. And where that hardware and man's ingenuity and determination have teamed up, we have found or are on the road to finding the answers we need.

The accomplishments to date in IDP in the Government are perhaps not as significant as the breakthroughs that are impending. But they are significant in the sense that we are learning about IDP by solving the less complex problems. For example, in a number of agencies today you can find instances in which a pattern has been found for integrating several types and categories of administrative resources data. Information about manpower, money and materiel are processed in one system and, at times, with production data added, are interrelated in ways that are far more meaningful to management than they were before integration took place.

There are "bigger fish to fry," however, in fields which involve the creation of integrated data processing systems for very complex management problems. Around the Government, particularly in the military departments, work on problems of this type is already underway or is being planned. Take the Navy, for instance, which in its air program must procure, maintain, overhaul, convert, and assign aircraft to operating units. For about as long as the Navy has used aircraft it has had one organizational unit which decides what aircraft will be bought, how many, and when. Another unit decides which aircraft to convert and when. Still another develops the plans by which aircraft are allocated to operating units. And, finally, other organizational units make arrangements for and decisions on maintenance, overhaul, operating support, manpower, and money. Since to a very large extent each of these organizational units generates for itself the data it uses to manage its aspect of the Navy air program, the most elaborate coordinating machinery must be used to achieve acceptable consistency among the various units in plans and operations. The Navy recognizes that despite the vastness and complexity of these interrelated activities, significant improvements would seem to be in store if for purposes of data processing the

entire air program could be considered as a whole. In terms of data integration, I suspect we would be hard put to find a problem more complex or more challenging than this. You can be sure the Navy will find the right answers. It will take time and a great deal of ingenuity. I suspect that some considerable reorganization may be in store. They probably will have to develop computer routines unlike any the experts have so far devised. But a logical and usable answer to data integration problems of this magnitude is on the horizon.

For the lesser IDP problems, answers are available now if we but look for them.

7. *Interagency integration of systems.*—Another subject engaging out attention today, and which holds great promise for the future, is the interagency integration of systems. I can explain that term by an example. The Veterans' Administration processes claims of veterans and their dependents for benefit payments under the GI bill of rights. Approved claims are turned over to the Treasury Department for checks to be written and these checks, stuffed in envelopes, are turned over to the Post Office Department for delivery. By voluntarily working together on their three separate systems, and by exploiting to the full the use of ADP equipment, these departments have worked out an arrangement whereby in the near future the magnetic tape developed by VA for benefit payments will be used also by Treasury for checkwriting; and in the preparation of this same tape, VA also will insert address codes which will make possible a mechanical presort of checks by locations, thus speeding the work of the Post Office Department.

There are other examples, such as the collaboration of the Treasury Department and the General Accounting Office in reconciling Government checks—with appreciable savings in processing time and costs, and with a higher degree of accuracy than was ever before possible.

We in the Bureau of the Budget are mounting a continuing campaign to exploit the many possibilities that must exist for interagency integration of systems. We know that the agencies also will lend their full support to this kind of integration, because the potential payoff will make it worth their while.

Now let us look ahead a bit. Where is the Government headed in ADP and in IDP? In terms of the so-called ADP program of the Government, what's in store? How fast or how slow should Government go in employing ADP equipment? What are the problems we have yet to face? Final answers to these and other questions are not easy to supply in the environment of 1960, but interim answers are now available and will be replaced as fast as possible with more definitive answers. In this connection, what I have said so far this morning should be interpreted to mean these five things:

First, that the Bureau of the Budget has a program for supplying administrative leadership in ADP utilization in the Government and will implement that program vigorously. All of our people—budget examiners, management analysts, statisticians, and accounting personnel alike, as well as the Director and his key assistants—are aware of the potential of ADP equipment for management improvement in the Government. A small staff of ADP specialists is being enlisted and organized to provide to the Bureau and to the agencies the general overall guidance and assistance needed as we move forward to exploit that potential.

Second, as determined as we are for the Government to move ahead in its exploitation of this new and rather fantastic equipment, we are equally determined that the pitfalls of the past and the new pitfalls to be encountered in the future will adequately be considered by the agencies and our own staff when ADP applications are being planned.

Third, in the Bureau of the Budget we expect no special or additional controls on individual ADP applications. The normal budget review process, long established, will continue to be our primary means of reviewing ADP applications. The underlying concept in the Government's ADP program and in our plans for giving leadership to that program is that we shall advocate and energetically support sound programs in the departments and in their bureaus for the management of their ADP equipment utilization. It has to be that way because no matter how effective the Bureau of the Budget or other central agencies may think they are in their overall leadership, if we do not achieve good ADP management at the departmental level and lower we just don't have good ADP management. (As the tobacco man says: "If you haven't got it there you haven't got it.")

Fourth, in the statistical and reports control programs of the agencies—and in the statistical standards activity of the Bureau of the Budget—we feel that the use of ADP equipment offers an opportunity to deal more effectively than ever before with one of the long-standing and perplexing problems of management,

namely, supplying accurate data to those who as supervisors and executives need and will use these data to make informed decisions. ADP does nothing if it does not assure an orderly flow of meaningful data for use in more effectively managing the multifold activities of our Federal Government.

In seeking to provide this, those who help to engineer the changes had best avoid becoming enamored of hardware. It is not hardware that gets the job done; it is systems—conceived in breadth and developed with clear objectives in mind. He who gets a fixation on equipment—what I would like to call "hardware hypnosis"—is in for trouble. Data development is systems oriented, not machine oriented, and when you ask too much of a machine, or distort your needs to fit equipment, to that extent are you unfaithful to the task ahead of you.

Fifth, as we in the Government move ahead in the ADP program, one very necessary ingredient must be present. This ingredient is essential in almost any program, but in ADP it is indispensable. I'm talking about common purpose, coordination, cooperation, or teamwork. When ADP equipment is being considered in any one of our departments—indeed, in some of our large bureaus and local installations—and certainly in the Government as a whole, organizational lines, functional lines, geographical lines, and even professional lines, which have presented barriers to efficient data processing systems in the past, no longer can be permitted to be barriers to effective data processing. If we pursue the broad systems approach, as we must; if we actually integrate data processing systems, which is inevitable; if we coordinate and integrate systems on an interagency basis as we have already begun to do; then compartmentalization will have to stand aside, artificial boundary lines will have to disappear and experts in science, engineering, finance, accounting, logistics, personnel, management analysis, and many other functional or professional fields will find that the only course to follow is one which involves a common effort.

There's a moral in this for a group of Federal Government accountants like yourselves. It is this: Whatever your philosophy about financial management data may have been or now is, that philosophy must recognize the mounting evidence which proves that although financial management data are indispensable to the Federal executive, their value to him will be almost in direct proportion to the extent to which those data have been integrated with other-than-financial data. These various types of data do not integrate themselves. You, as the financial members of an integration team will, in a joint endeavor with the other members of your team, bring about that necessary integration. It is a great challenge and an exciting one for you and for all of us.

I want to be sure that what I have thus far said this morning does not leave the impression that the things we need to accomplish in ADP utilization will be easy. To the contrary, and even with the finest cooperation of all of Government and all of industry there are many bridges yet to be crossed. I have already mentioned some. Among the others we now recognize, here are a few:

1. *The centralization-decentralization problem.*—This is one we have had for years, of course. It has a habit of cropping up frequently. And now with computers we in many cases may have to reconsider our last decision on this problem. ADP equipment encourages centralization of data processing; as a matter of fact in some cases the justification for acquiring ADP equipment becomes valid only if centralization takes place.

2. *The ADP equipment compatibility problem.*—This problem likely will plague the Federal Government for a long time to come. However, some inroads already have been made; for example, the Department of Defense-sponsored study, with aid from the equipment manufacturers, has produced COBOL (common business oriented language) which under proper conditions can be used to overcome in part some of the incompatibility questions many of our agencies face. But there are more aspects of the incompatibility problem. I am sure we can count upon the manufacturers to work with the Government toward a solution of every aspect of the problem.

3. *The vulnerability problem.*—Since we are staking so much on the capabilities of our computers to process data which are essential to the continued operation of Government functions that are as necessary in wartime as in peacetime, we have a big job ahead to assure the preservation and continued operation of our equipment under all conditions and at all times. As in the compatibility problem, we have made some progress in dealing with the matter of vulnerability—but we have a long way to go to solve this one.

4. *The progress assessment problem.*—How effectively have we used ADP equipment in the Government up to this time? Finding answers to this question has been both difficult and enlightening when we use the few criteria so far developed

for assessments of this kind. As yet we haven't enough criteria and we are not fully confident that the criteria available are the right kind to use. But with the help of the departments, some of which have already begun to develop assessment procedures, a pattern will soon be developed for evaluating progress and status in the utilization of ADP equipment. You can well understand why we in the Bureau are anxious to reach the point at which we and the departments have developed tried-and-proven Government-wide procedures for assessing progress in ADP utilization.

I have thus far given you some of the findings resulting from the limited evaluation measures which have been employed to date. Here are a few more findings:

(*a*) Almost invariably, ADP costs are underestimated. Variances run as high as 50 percent over budget expectations. This is due to several causes such as underestimation of machine time required; failure to allow for setup time, down time and maintenance; and the fallacious assumption that workload will remain constant, which rarely occurs.

(*b*) The purposes behind the acquisition of a computer are often so vague or general as to leave the impression that the real purpose is to get the computer first, then figure out how to use it or what to use it for. In enough cases to cause alarm, this is substantially what has happened. I am sure you will agree that before we get computers we ought to have specific plans for their use.

(*c*) Computer programing, systems analysis and the writing of instructions with rare exceptions take longer than expected—sometimes over twice as long.

(*d*) There seems to be a general tendency to overlook certain cost items when estimates are made; for example, supporting equipment, building modification, training and travel.

(*e*) Punched-card equipment due to be given up when the computer is installed somehow is not released in some cases. And in many cases punched-card or manual systems due to be discontinued are not, so we end up with duplicate systems.

(*f*) In cases involving parallel operations, that is, when the new ADP system and the old system operate concurrently until the new system is thoroughly debugged, we find that more often than not the period of parallel operations is excessive—6 months, for example, when 1 or 2 months would be ample.

5. *Balance of use.*—The uses of computers may be put into five major categories: Business management, science, engineering, military operations and intelligence. In the first of these categories, business management, we find that the trend in ADP utilization to date has been to concentrate upon the administrative type of system—such as payroll, personnel accounting, cost accounting, appropriation accounting, inventory accounting and the like—while the substantive operations of many of the agencies have been ignored or intentionally set aside for the time being. This kind of imbalance was to be expected. It is also to be expected that the agencies will do something about it soon. The fact that the Interagency Committee on ADP has also pointed to this imbalance is a good sign that it will be getting the proper attention.

At this point in time we are not sure of the kind and degree of balance that now exists or should exist between the five categories of use I have named. We are studying this now.

Please don't get the idea that our findings are all as unfavorable as the ones I have been describing. On the contrary, there are numerous ADP applications to which we can point with some measure of pride. Many novices and neophytes in the ADP field are consistently being urged to visit these and other "going" operations in order to see at first hand how computers have been geared up to do a creditable job.

Certainly, not all ADP applications will always be models of efficiency. But we are learning fast and we firmly believe we have occasion even now to be confident that on the whole, throughout the Federal Government, we are going to do even better than a creditable job in applying ADP equipment to our operations. I feel certain that you as individuals, your association, and the departments you work for will make significant contributions to that ambitious goal.

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